
Meridian 1

Meridian Internet Telephony Gateway (ITG) Line 2.0/i2004 Internet Telephone

Description, Installation, and Operation

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About this document

This document describes the physical and functional characteristics of the Meridian Internet Telephony Gateway Line 2.0 (NTZC80) card and the i2004 Internet Telephone (NTEX00). The document also explains how to engineer, install, configure, administer and maintain a network node that contains the Meridian Internet Telephony Gateway Line 2.0 card and the i2004 Internet Telephone in Meridian 1 large and small systems.

Description

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Reference list

The following are the references in this section:

- *X11 Features and Services* (553-3001-306)

Overview

The Meridian Internet Telephony Gateway (ITG) Line 2.0 card supports the i2004 Internet Telephone by providing a communication gateway between the IP data network and the Meridian 1. The i2004 Internet Telephone translates voice into data packets for transport using Internet Protocol (IP). A Dynamic Host Configuration Protocol (DHCP) server can be used to provide required information to enable the i2004 Internet Telephone network connection and connect to the ITG Line 2.0 card. The i2004 Internet Telephone uses the customer’s IP network to communicate with the ITG Line 2.0 card and the optional DHCP server. Figure 1 on page 15 shows a system block diagram.

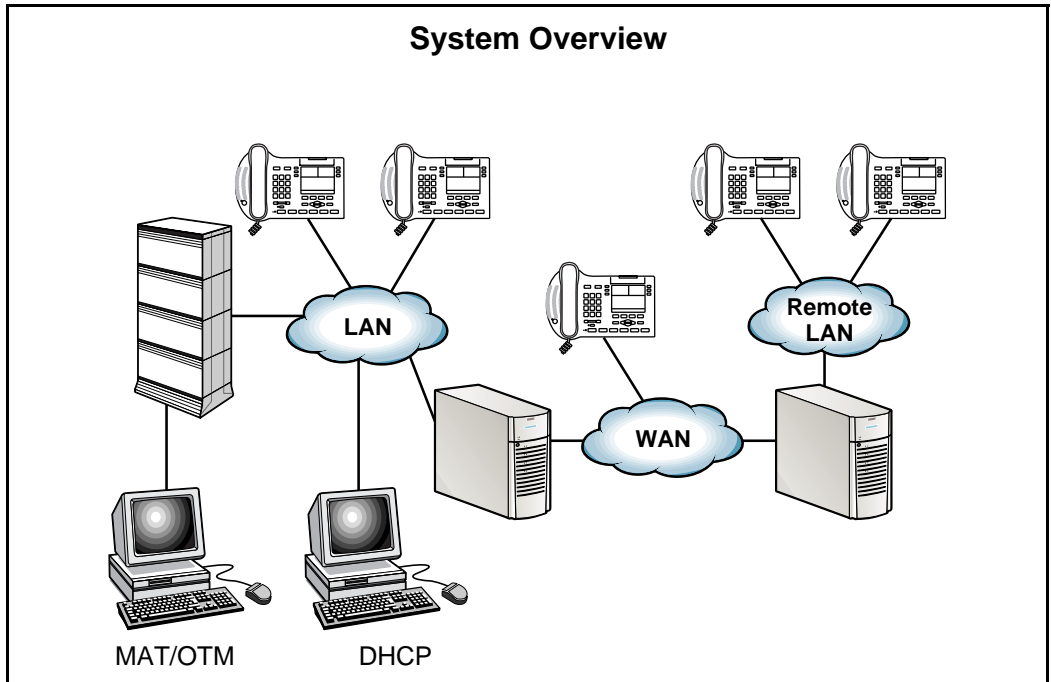
Applicable systems

The ITG Line 2.0 card is supported on Meridian 1 large and small systems.

Meridian ITG line 2.0 is not supported on the following products:

- Carrier Remote
- Mini-carrier Remote

Figure 1
System block diagram



- Fiber Remote
- Fiber Remote Multi-IPE

System requirements

The ITG Line 2.0 card requires the following software:

- X11 Release 25.30 or later software
- MAT 6.67.07 or OTM 1.0 or later

Software delivery

Meridian ITG line-side 2.0 supports software delivery through a CD-ROM. The CD-ROM is inserted into the CD-ROM drive of the MAT PC and subsequently downloaded to the ITG 2.0 card.

ITG Line-side software and related documentation such as General Release Bulletins can also be downloaded from the Meridian 1 Electronic Software Distribution (ESD) web site at:

<http://www.nortelnetworks.com/servsup/esd/meridian/>

For additional information on registering for access to the M1ESD site, please refer to the Generic X11 Release 25 Software Product Bulletin.

Required packages

The ITG Line 2.0 card and i2004 Internet Telephone require the software packages listed in Table 1.

Table 1
Required packages

Package	Package number
Digital Set Package (DSET)	88
Aries Terminal Package (ARIES)	170

ITG Line 2.0 and i2004 Internet Telephone package components list

Table 2 lists ITG Line 2.0 package components. Table 3 on page 18 lists the i2004 Internet Telephone package components.

Table 2
Meridian ITG Line 2.0 package components

Component	Code
Meridian ITG - Line 2.0 Systems Package. Includes Meridian ITG Line 2.0 card (contains G.711, G729A and G.729AB codecs), ITG Lineside 2.0 software CD-ROM, cables, M1 Backplane to 50-pin I/O Panel Mounting Connector, NTP CD-ROM	NTZC81AA
Meridian ITG Line 2.0 card assembly and required software licences	NTZC80AA A0804145 Note: These are the order codes.
Meridian ITG Line 2.0 card	NTVQ55AA Note: This is the code on the line card faceplate. It is not orderable.
PC Maintenance cable	NTAG81CA A0655007
E-LAN, T-LAN, RS232 interface cable	NTMF94EA A0783470
Package of eight i2004 Internet Telephony User Guide	NTLH45AA A0805445 (P0910804)
Meridian ITG Line software CD	NTDW80AA A0804147
Meridian ITG Line card NTP	P0910806
ISM Parameter - For a single i2004 Internet Telephone (Large System)	NTZC82AA A0804340

Table 2
Meridian ITG Line 2.0 package components

Component	Code
ISM Parameter - For a single i2004 Internet Telephone (Small System)	NTZC84AA A0808998
M1 Backplane to 50 Pin I/O Panel Mounting connector with ITG specific filtering	NTCW84JA A0783483

Table 3
i2004 Internet Telephone package components

Component	Code
i2004 Internet Telephone Boxed Package. Contains 7 ft. Ethernet cable, i2004 Installation Guide, Power Transformer, Telephone Handset, Telephone Handset Cord, Telephone Footstand.	NTEX00BA B0253074
i2004 Internet Telephone Boxed Package. Contains 7 ft. Ethernet cable, i2004 Installation Guide, Telephone Handset, Telephone Handset Cord, Telephone Footstand.	NTEX00BB
7 ft. Ethernet cable, Category 5	A0648375
Telephone Footstand	P0886045
Telephone Handset Cord	A0788682
Telephone Handset	A0788874
Power Transformer (117/120 VAC 50/60 Hz) (North America only)	A0619627
Power transformer AC to AC, direct plug-in, 8W, 230 VAC, 50/60 Hz, to 16 VAC at 500mA	A0619635
Power transformer 2 prong wall plug, direct plug in AC to AC, 8W 240 VAC, 50 Hz to 16 VAC/500mA	A0647042
Power transformer 3 prong AC to AC, direct plug-in, 8W, 240 VAC, 50 Hz, to 16 VAC/500mA	A0656598

Ordering rules for ITG Line 2.0

An ITG Line 2.0 node requires:

- one NTZC81AA Meridian ITG - Line 2.0 systems package.
- one NTEX00BA i2004 Internet Telephone boxed package.

Marketing packages contain 24-port ITG Line 2.0 card with G.711, G.729AB, G.729B codecs, IP Lineside software and NTP CD-ROM. CD-ROM for upgrades are sold separately.

MAT/OTM is a prerequisite and must be ordered separately. MAT/OTM automatically includes the **ITG IP Phones** application, used to configure, administer, and maintain the Meridian 1 ITG 2.0 card and i2004 Internet Telephone products.

Note: The MAT Alarm and Notification application is not automatically included in MAT/OTM and must be ordered separately.

Customers must purchase one NTZC82AA Internet Telephone ISM parameter for each i2004 Internet telephone phone required on Large Systems.

Customers must purchase one NTZC84AA Internet Telephone ISM parameter for each i2004 Internet Telephone purchased for small systems (default is zero).

The ISM parameter uses the existing Meridian 1 keycode to enable i2004 Internet Telephone software in the X11 Release 25 software. If you add ISM limits for the i2004 Internet Telephone, you must order and install a new keycode. Refer to the Incremental Software Management feature module in the *X11 Features and Services* (553-3001-306) NTP.

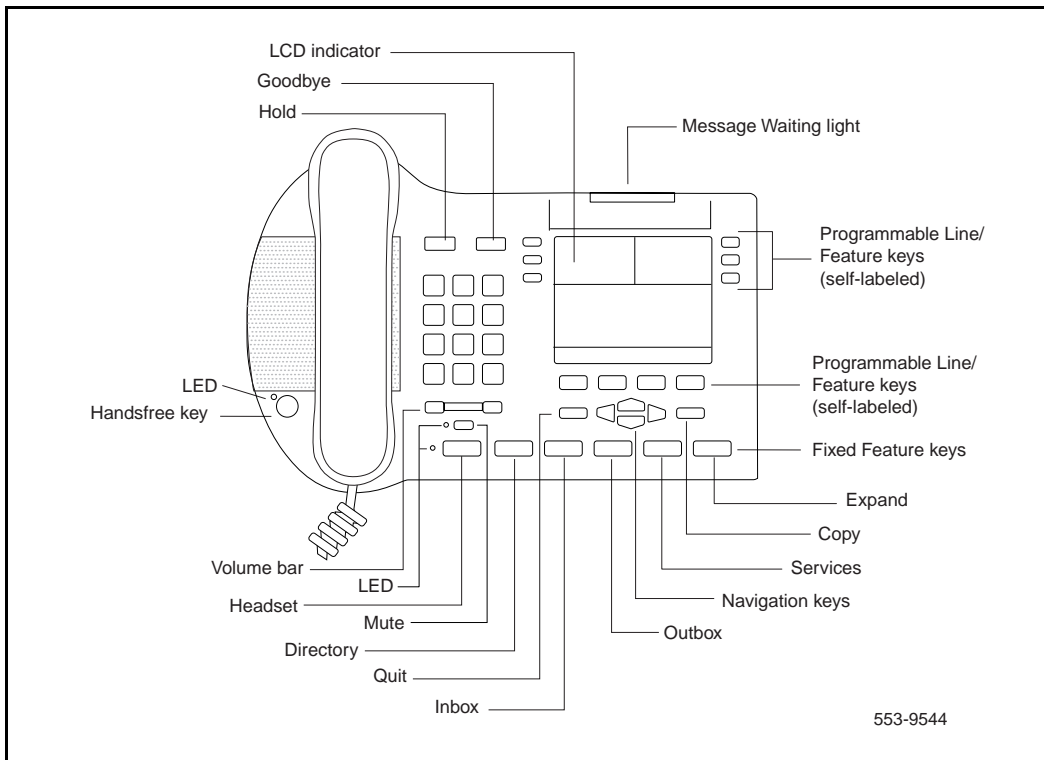
The NTLH45AA Meridian 1 i2004 Internet Telephone User Guide is sold separately from the i2004 Internet Telephone. An installation guide is sold with each i2004 Internet Telephone.

No keycode or security device is used on the ITG Line 2.0 card.

i2004 Internet Telephone physical and functional description

The i2004 Internet Telephone translates voice into data packets for transport using Internet Protocol. A Dynamic Host Configuration Protocol (DHCP) server can be used to provide information that enables the i2004 Internet Telephone network connection, and connection to the Internet Telephony Gateway Line 2.0 card. The i2004 Internet Telephone uses the customer's IP network to communicate with the ITG Line 2.0 card and the optional DHCP server. Figure 2 identifies the i2004 Internet Telephone feature keys and other components.

Figure 2
i2004 Internet Telephone components



ITG Line 2.0 card physical description

The ITG Line 2.0 card (NTZC80AA) plugs into an Intelligent Peripheral Equipment (IPE) shelf. Each ITG Line 2.0 card occupies two slots.

ITG Line 2.0 cards have an E-LAN management Ethernet port (10BaseT) and a T-LAN VoIP Ethernet port (10/100BaseT) on the I/O panel. There is an RS-232 Maintenance Port connection on the ITG Line 2.0 card faceplate and an alternative connection to the same serial port on the I/O backplane.

Note: Do not connect maintenance terminals to both the faceplate and I/O panel serial maintenance port connections at the same time.

ITG Line 2.0 controls, indicators and connectors

Figure 3 on page 22 shows the ITG Line 2.0 card faceplate components. The information in this section describes the components.

Faceplate components

NWK

The faceplate connector labeled NWK is a 9-pin, sub-miniature D-type connector. The connector is not used for the ITG Line 2.0 application.

WARNING

The NWK connector looks like a 9-pin serial connector. **DO NOT** connect a serial cable or any other cable to it. If you install a cable to the NWK connector, you will disable the T-LAN.

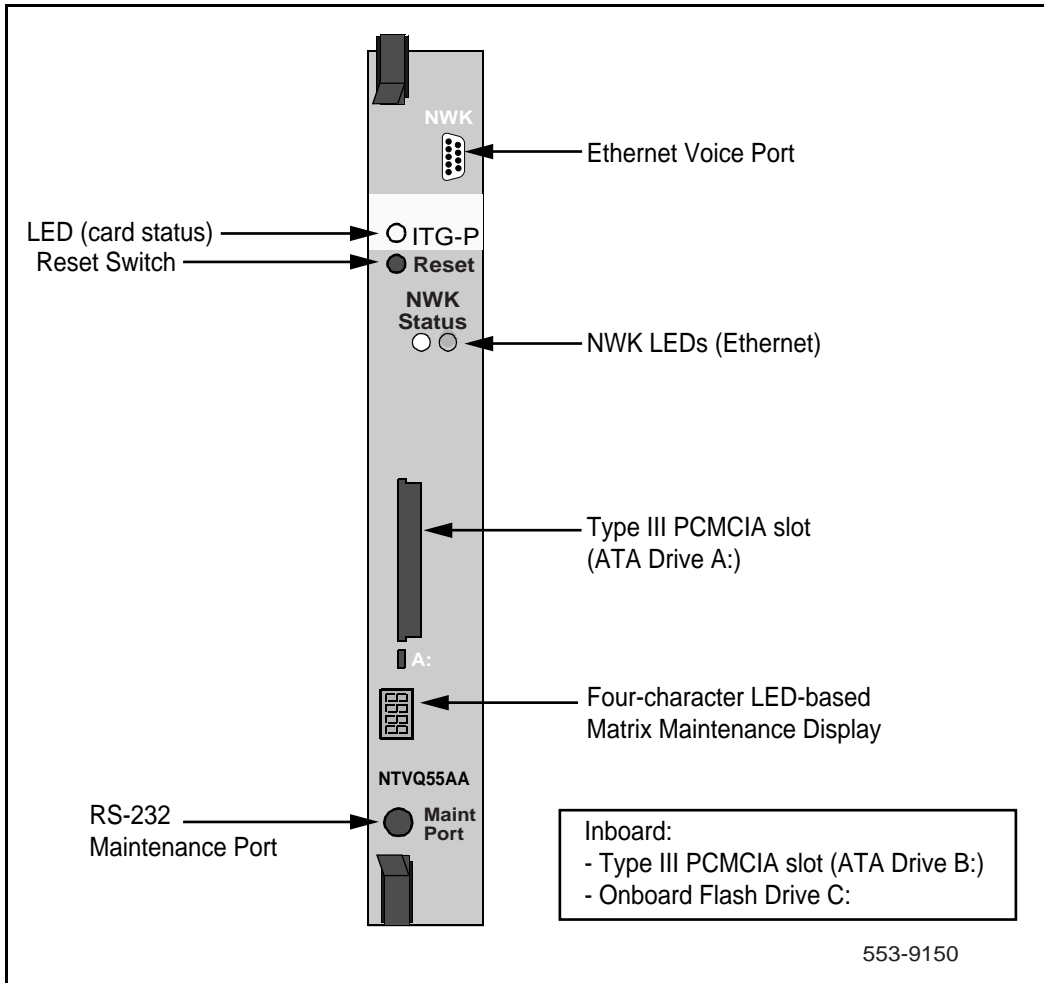
ITG-P LED (Card Status)

The red status faceplate LED indicates the enabled/disabled status of the 24 card ports. The LED is on (red) during the power-up or reset sequence. The LED remains lit until the card is enabled by Meridian 1. If the LED remains on, the self-test failed, the card is disabled, or the card rebooted.

Reset switch

Press the Reset switch to reset the card without having to cycle power to the card. This switch is normally used after a card software upgrade to the card or to clear a fault condition.

Figure 3
ITG Line 2.0 card



NWK Status LED

NWK Status LEDs display the T-LAN Ethernet activity.

- Green - on if the carrier (link pulse) is received from the T-LAN Ethernet hub.

- Yellow - flashes when there is T-LAN data activity. During heavy traffic, yellow can stay continuously lit.

Note: There are no Ethernet status LEDs for the E-LAN management interface.

PC Card slots

The ITG Line 2.0 card has one faceplate PC card slot (designated drive A:). It is used for optional maintenance (backup and restore). The ITG Line 2.0 also has one unused inboard slot (designated drive B:). The PC Card slots support PC based hard disks (ATA interface) or high-capacity PC flash memory cards.

Maintenance Display

A four character, LED-based, dot matrix display shows the maintenance status fault codes and other card state information.

RS-232 Maintenance Port (Maint. Port)

The ITG Line 2.0 card faceplate provides a female DIN-8 serial maintenance port connection (labeled Maint Port). An alternative connection to the faceplate serial maintenance port exists on the NTMF94EA I/O panel breakout cable. **Do not** connect maintenance terminals or modems to the faceplate and I/O panel DB-9 male serial maintenance port at the same time.

Backplane interfaces

The backplane connector provides DS-30X and Card LAN interfaces.

DS-30X voice/signaling

DS30X carries Pulse Code Modulation (PCM) voice and proprietary signaling on the IPE backplane between the ITG Line 2.0 card and the Intelligent Peripheral Equipment Controller (XPEC).

Card LAN

Card LAN carries card polling and initialization messages on the IPE backplane between the ITG Line 2.0 card and the Intelligent Peripheral Equipment Controller (XPEC).

Assembly description

The ITG Line 2.0 card assembly consists of a two-slot motherboard/daughterboard combination. A PCI interconnect board connects the ITG motherboard and the DSP daughterboard.

ITG Line 2.0 card functional description

The ITG Line 2.0 card performs two separate functions:

- 1** It acts as a gateway between the Time Division Multiplexing (TDM) voice switching network and the IP network.
- 2** It acts as Terminal Proxy Server (TPS) or "virtual line card" for the i2004 Internet Telephone.

The TPS portion of the cards connect through the E-LAN port to the Meridian 1 CPU through the CPU Ethernet port. The Gateway portion of the card connects to the Meridian 1 through the DS30X backplane. The Gateway portion also receives call speech path setup and codec selection commands through the E-LAN port. The i2004 Internet Telephone connects to both the Gateway and TPS functions through the T-LAN port.

Gateway functional description

The Gateway:

- Registers with the PBX using the TN Registration messages
- Accepts commands from the PBX to connect/disconnect audio channel
- Uses RTP/RTCP protocol to transport audio between the gateway and the i2004
- Encodes/Decodes audio from PCM to/from i2004's format
- Provides echo cancellation for the speaker on the i2004

Virtual TNs

Virtual TNs (VTNs) allow you to configure service data for a terminal, such as key layout and class of service, without requiring a physical terminal to be directly connected to the PBX.

The concentration of i2004s Telephones is made possible by dynamically allocating a port (also referred to as a Physical TN) of the ITG card for a TDM – i2004 call. All Meridian 1 speech path management is done with Physical TNs instead of the Virtual TNs.

The choice of the port is not restricted to the ITG where the TPS handling that particular i2004 is running. The port can be chosen among all the ITGs dedicated to i2004s. The i2004s (Virtual TNs) are defined on Virtual superloops.

A virtual superloop is a hybrid of real and phantom superloops. Like phantom superloops, no hardware (for example, XPEC or line card) is used to define and enable units on a virtual superloop. As with real superloops, virtual superloops use the time slot map to handle i2004 Internet Telephone (Virtual TNs) to i2004 Internet Telephone calls.

Terminal proxy server (TPS) description

The TPS maintains a count of the number of sets registered to the card. Each node has one active master. The active master broadcasts to all ITG cards requesting a response if it has room for another set. 96 is the maximum number of sets per card.

The Election function uses a selection process to determine the node's master.

The Census function determines the ITG cards within a node.

Virtual Terminal Manager (VTM) description

The Virtual Terminal Manager:

- arbitrates application access to the i2004s.
- manages all the sets between the applications and the stimulus messaging to the set.
- maintains context sensitive states of the set (for example, display or lamp state).
- isolates set-specific information from the applications (for example, the number of display lines, number of characters for each display line, tone frequency and cadence parameters).

Interactions with i2004 Internet Telephone

When you add an i2004 Internet Telephone to the network, the telephone sends a request to the DHCP server identifying itself as an i2004 Internet Telephone and requests IP parameters and a Connect Server address. The i2004 Internet Telephone then contacts the Connect Server which instructs the i2004 Internet Telephone to display a message on its display screen requesting the customer's node number and TN. After the customer enters this information, the i2004 Internet Telephone contacts the Node Master which selects a TPS with sufficient capacity to register the i2004 Internet Telephone. The chosen TPS contacts the i2004 Internet Telephone, and if the i2004 Internet Telephone is valid, registers it with the Meridian 1. The registration information is then saved to the i2004 Internet Telephone.

Unregistration

If the ITG Line 2.0 card detects a loss of connection with one of its registered i2004 Internet Telephones, it logs the event and sends an unregister message to the Meridian 1 for that i2004 Internet Telephone.

Codecs

Codec refers to the voice coding and compression algorithm used by the DSPs on the ITG Line 2.0 card. Different codecs provide different levels of voice quality and compression properties. The specific codecs used and the order in which they are to be used, is configured in the TPS and Meridian 1.

The ITG Line 2.0 card supports the G.711, G.729A and G.729AB codecs.

Signaling and messaging

The ITG Line 2.0 sends SSD messages through the Meridian 1 E-LAN using the UDP protocol. When tone service is provided, it is signaled to the TPS using new SSD messages sent through the E-LAN.

Signaling protocols

Signalling between the i2004 Internet Telephone and the ITG Line 2.0 card uses the Unified Networks IP Stimulus Protocol (UNISim) with the Reliable User Datagram Protocol (RUDP) as the transport protocol.

RUDP

Reliable User Datagram Protocol (RUDP) is used for E-LAN communications between the Meridian 1 CPU and the ITG Line 2.0 cards, and for T-LAN communications between the ITG Line 2.0 cards and the i2004 Internet Telephones. RUDP is another layer on top of UDP. RUDP is proprietary to Nortel Networks.

RUDP features:

- Reliable communication system over a network
- Packages are resent if an ACK is not received following a time-out
- Messages arrive in the correct sequence
- Duplicate messages are ignored
- Loss of contact detection

When a data sequence is packetized and sent from source A to receiver B, the RUDP protocol adds a number to each packet header to indicate its order in the sequence.

- If the packet is successfully transmitted to B, B sends back a ACK (acknowledge) message to A, acknowledging that the packet has been received.
- If A receives no message within a configured time, it retransmits the packet.
- If B receives a packet without having first received its predecessor, it discards the packet and all subsequent packets, and sends A a NAK (no acknowledge) message which includes the number of the missed packet. A retransmits the missed packet and continues from there.

UNIStim description

The Unified Network IP Stimulus Protocol (UNIStim) is the single point of contact between the various server components and the i2004 Internet Telephone.

UNIStim is the stimulus-based protocol used for communication between an i2004 Internet Telephone and a Terminal Proxy Server on the ITG Line card.

Zones

To optimize ITG traffic bandwidth use between different locations, the ITG network is divided into “zones” representing different topographical areas of the network. All i2004 Internet Telephone and ITG ports are assigned a zone number indicating which zone they belong to. When a call is made, the codecs used vary depending on which zone(s) the caller and receiver are in. By default:

- Connections between units in the same zone will select codecs to optimize voice quality.
- Connections between units in different zones will select codecs to optimize bandwidth usage.

Each zone can be configured to optimize either voice quality or bandwidth usage for calls between users in that zone. Each zone can be configured to optimize either voice quality or bandwidth usage within a zone and all traffic going out of a zone. See “IP Voice zones” on page 64.

Administration

The ITG Line 2.0 card provides two management interfaces:

- A Graphical User Interface (GUI) provided by MAT 6.67.07 or OTM 1.0, (or later).
- A Command Line Interface (CLI).

Note: You can also perform some maintenance tasks on the ITG Line 2.0 using Overlay 32 and other Meridian 1 Overlays.

MAT ITG - IP Phones application

You must use MAT/OTM to create a node, add cards to the node, transmit software to the cards, upgrade software, define SNMP alarms, Codecs and other related tasks.

Command Line Interface

The ITG Command Line Interface (CLI) provides a text-based interface to perform some specific ITG Line 2.0 card installation, configuration, administration, and maintenance functions. You can establish a CLI session by connecting a TTY or PC to the card serial port.

With a CLI session established, you can enter the Leader card IP address. MAT/OTM uses the card IP address to carry out configuration and software download functions.

Supported features

The i2004 Internet Telephone supports the full Meridian digital set feature compliment available on the M2000 series telephones.

Feature highlights include:

- Multi Line
- 6 self-labelled programmable line/feature keys. One must be the DN key.
- 6 icon-labelled fixed feature keys
- 4 self-labelled programmable feature keys provide access to multiple features
- Handsfree with LED
- Dual purpose LED indicator: Message waiting (solid), Incoming call (flashing)
- Navigation cluster (up/down, left/right)
- Direct connect headset port

Physically the i2004 Internet Telephone is very similar to the M3900 digital telephone, however it is important to note that there are distinct differences between the two sets.

The M3900 series portfolio contains a new feature that eliminates paper labelled keys. Line and feature keys are now "self-labelled". This means that once the phone is configured within the system, the line and feature key labels are automatically presented to the user through the display. This significantly reduces the initial installation and designation time. It also reduces ongoing maintenance charges associated with re-designation when programming changes occur or new feature are added.

Self-labelled soft keys are also delivered on the i2004 Internet Telephone. This feature is further simplified on the i2004 Internet Telephones because it is not necessary to physically connect the telephone back to a specific hardware port on a line card.

However, some of the new features available on the M3900 series are not currently supported on the i2004 Internet Telephone.

Specific features **not** available include:

- Personal Directory
- Call Log and redial List
- Expansion Modules
- Support of accessory modules
- User customizable feature keys
- Live Dial pad
- Group Listening
- Shift key for six additional feature keys
- Set to set messaging
- Hot desking
- Context sensitive soft keys

The i2004 Internet telephone supports the Meridian ACD feature set. There are specific limitations that should be noted if you are using the set in an ACD environment:

- There are six feature keys that can be configured for ACD functionality (One of ACD in-calls and five others)
- The headset does not support the ACD Walkaway feature. If the headset is unplugged, ACD Walkaway is not invoked.

i2004 Internet Telephone restricted keys

Table 4 describes the specific telephone assignment functions you can program for Keys 16-26 on the i2004 Internet Telephone using Overlay 11.

Note: If you attempt to configure anything other than the permitted response, Meridian 1 generates an error code.

Table 4
i2004 Internet Telephone dedicated key assignments (LD 11).

i2004 Internet Telephone key number	Response(s) Allowed
Key 16	MWK, NUL MWK - Message Waiting key
Key 17	TRN, NUL TRN - Call Transfer key.
Key 18	A03 or A06, NUL A03 - 3-party conference key. A06 - 6-party conference key.
Key 19	CFW, NUL CFW - Call Forward key.
Key 20	RGA, NUL RGA - Ring Again key.
Key 21	PRK, NUL PRK - Call Park key.
Key 22	RNP, NUL RNP - Ringing Number pickup key
Key 23	SCU-Speed Call User SSU-System Speed Call User SCC - Speed Call Controller SSC - System Speed Call Controller NUL

i2004 Internet Telephone key number	Response(s) Allowed
Key 24	PRS, NUL PRS - Privacy Release key.
Key 25	CHG, NUL CHG - Charge Account key.
Key 26	CPN, NUL CPN - Calling Party Number key.

Meridian 1 capacity engineering guidelines

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Overview

This chapter provides capacity engineering guidelines to help plan and engineer Meridian 1 to support the Meridian 1 ITG Line 2.0 card and the i2004 Internet Telephone. The section includes hardware and software requirements, product compatibility information, electrical and environmental specifications, and a description of the IP address requirements.

Refer to “IP Network engineering guidelines” on page 55 for IP Network Engineering information.

Refer to “ITG MAT 6.67.07 (with update disk)/OTM 1.0 management PC” on page 159 for information on how to configure MAT 6.6/OTM 1.0 to support the ITG Line 2.0 card and the i2004 Internet Telephone.

Refer to “Configuration of the DHCP server” on page 97 for engineering guidelines to set and configure the Dynamic Host Configuration Protocol (DHCP) server to support the ITG Line 2.0 card and i2004 Internet Telephone.

X11 system software requirements

The ITG Line 2.0 and i2004 Internet Telephone requires X11 Release 25.30 software (or later). Table 5 lists the X11 software package requirements.

Table 5
X11 software package requirements

Package mnemonic	Package number	Package description
DSET	88	Digital set package
ARIES	170	Aries terminal package

MAT version requirements

The ITG Line 2.0/i2004 Internet Telephone product requires MAT 6.67.07/OTM 1.0 (or later). Refer to “ITG MAT 6.67.07 (with update disk)/OTM 1.0 management PC” on page 159 for specific MAT requirements.

ISM limits

Customers must purchase one NTZC82AA Internet Telephone ISM parameter for each i2004 Internet Telephone required on Large Systems. Customers must purchase one NTZC84AA Internet Telephone ISM parameter for small systems. The default is zero. A new ISM parameter uses the existing Meridian 1 keycode to enable i2004 Internet Telephone software in the X11 Release 25 software. If you add ISM limits for the i2004, you must order and install a new keycode. Refer to the ISM feature module in the 553-3001-106.

i2004 Internet Telephone firmware requirements

The i2004 Internet Telephone has field upgradable firmware. A copy of this firmware is stored on each ITG Line 2.0 card in the system to automatically upgrade i2004 sets if an upgrade is required. All i2004 Internet Telephones in a system **must** use the same version of firmware as the ITG line 2.0 card.

Firmware Upgrade from a new ITG Line 2.0 card

When the ITG Line 2.0 card is received from the factory, it has the latest i2004 firmware already installed in the /C:/FW directory. As each i2004 Internet Telephone comes on-line, its firmware version is automatically compared to the version that is stored on the ITG Line 2.0 card. If they are different, a process is started which downloads the new firmware from the ITG line card to the i2004 Internet Telephones. After the new firmware has been downloaded, the i2004 reboots and registers again with the ITG Line 2.0 card.

Firmware Upgrade of an ITG Line 2.0 card

It is possible to upgrade the i2004 Internet Telephone firmware in the field. The first step is to upgrade the ITG line cards with the latest firmware version. This is accomplished by downloading the firmware directly from the Meridian 1 Electronic Software Documentation (ESD) website to each ITG line 2.0 card in the system. Refer to Procedure 23, “Upgrade i2004 Internet Telephone firmware” on page 156 for step-by-step instructions.

Make note of the following caveats:

- The i2004 Internet Telephone is shipped from the factory with sufficient firmware to complete the initial download.
- The firmware is downloaded to the i2004 set if it is different, which means that it is possible to download an older version of the firmware.
- The i2004 Internet Telephone uses trivial file transfer protocol (TFTP) to transfer the firmware, therefore the customer’s network must support TFTP. For example, the customer’s network cannot be blocked by a firewall.

The next step is to select each ITG Line 2.0 card in turn, and upgrade the firmware with the latest firmware file downloaded from the web.

IMPORTANT

Refer to Procedure 23 at this point, for the actual steps required to complete this firmware installation. There is **some risk** involved which can result in taking all the i2004 Internet Telephones inadvertently out of service.

Note: The i2004 Internet Telephone will not necessarily register with the same card as before the upgrade occurred.

System Resources

This section explains how to calculate Meridian 1 system capacity when engineering the ITG Line 2.0/i2004 Internet Telephone.

ITG capacity

Table 6 lists the System ITG capacity for cards, sets, and gateway ports.

Table 6
System ITG capacity

Parameter	Capacity
ITG cards per system	Each card requires two slots (subject to EMC restriction, see “Electromagnetic Compatibility requirements” on page 43)
i2004 Internet Telephone per card	Maximum of 192 sets supported per card.
Gateway ports per card	Maximum of 24 IP to TDM gateway ports per card. Subject to codecs used.

Capacity engineering considerations

- Number of sets per system:
 - Option 11C or 11C Mini - 640
 - Large Systems - limit is determined by engineering of real time usage, traffic capacity and IPE slot usage.
- Maximum ITG cards running i2004 application in system:
 - Eight ITGs maximum in Option 11C or 11C MiniC
 - In all large systems (Option 51-81C) maximum ITG card limit is determined by IPE slot usage.
 - Maximum of 96 i2004 Internet Telephones per ITG Line 2.0 card. Refer to “Traffic capacity of ITG cards when supporting i2004 Internet Telephones” on page 38
- Option 11C: Maximum of five Virtual superloops on Cards 61-80 (640 sets)

Note: Phantom superloops, Virtual superloops and Real superloops contend for the same five superloops.

Traffic capacity of ITG cards when supporting i2004 Internet Telephones

Each ITG Line 2.0 card has 24 ports that are used for establishing a voice connection between i2004 Internet telephones and non-Internet Telephones, such as digital telephones or public network. To configure a system as non-blocking (as is typically the case for ACD configurations), ensure only 24 i2004 Internet Telephones per card are registered.

A registered set is not synonymous with a configured set. When a set is registered it is as though the set is plugged in. When the set de-registers, it is as though the set was unplugged. Registration consists of two steps:

- verifying the users TN is valid
- associating the TN on the Meridian 1 side.

If an i2004 Internet Telephone is unplugged, it will automatically become un-registered after a pre-determined time-out. This limitation on simultaneous calls depends not on the number of ports, but on the number and type of calls.

A call between two i2004 Internet Telephones on a Meridian 1 does not use the ITG line card as a voice path across the data network.

ITG Line 2.0 cards in a Meridian 1 are pooled resources assigned dynamically. An i2004 Internet telephone can be assigned any port of any ITG Line card within the Meridian 1 system.

Refer to the following two examples for further clarification:

Example 1:

150 sets with "typical" business usage of 6 CCS* per set on average (e.g. 5 calls of 120 seconds duration per hour)

- $150 \times 6 \text{ CCS} = 900 \text{ CCS}$
- 2 ITGs required (see Table 1 on page 40)

Example 2:

500 sets with "heavy" business usage of 12 CCS per set on average (e.g. 6-7 calls of 180 seconds duration per hour)

- $500 \times 6 \text{ CCS} = 6000 \text{ CCS}$
- 8 ITGs are required (see Table 1 on page 40 - eight ITGs support up to 6013 CCS)

Example 3:

48 Call Center Agents with allocation of 36 CCS per set

- 2 ITGs are required (48 ports required/24 ports per ITG card = 2 ITG cards)

Note: For Call Center Agents, it is recommended that one ITG port be provisioned for each agent.

*CCS = The number of hundreds of call seconds per hour.

i2004 Set Engineering

Traffic and Service Circuits

i2004 sets are engineered similar to existing digital sets (based upon 3500 CCS per Virtual Loop). TDS/Conference circuits are provisioned like existing digital sets (one TDS/CONF card per half group of i2004 sets).

The recommendation is to use 5 ITG cards per shelf. I.e. 5 ITG cards per superloop, to eliminate ITG-superloop blocking. Use the following table to determine the number of ITG cards required to maintain the recommended capacity:

Table 1
ITG card recommendations based on CCS capacity

i2004 Internet Telephone blocking probability is 0.005	
Number of ITG cards	Capacity CCS
1	511
2	1232
3	1996
4	2780
5	3577
6	4383
7	5196
8	6013
9	6835
10	7660
11	8488
12	9318
13	10144
14	10983

Table 1
ITG card recommendations based on CCS capacity

i2004 Internet Telephone blocking probability is 0.005	
Number of ITG cards	Capacity CCS
15	11818
16	12657
17	13496
18	14335
19	15177
20	16020

Note 1: CCS is the number of hundred call seconds per hour

Note 2: If the number of ITG Line 2.0 card exceeds 20, add 801 CCS to the total capacity for each additional card.

Real time factors

The real time factors for i2004 Internet Telephones is given in Table 2 on page 41.

Table 2
Real time factors for i2004 Internet Telephones

Call scenario	Real time Factors
1 - way inbound	0.78
1 - way outbound	1.59
2- way	2.95

The total real time capacity of the Meridian 1 depends on many factors such as:

- calling patterns
- feature operations
- set and trunk signalling
- system CPU capacity

These factors are used to provision the maximum number of i2004 Internet Telephones supported on specific Meridian 1 system types. These factors also describe the impact of using i2004 Internet Telephones relative to real time usage for a basic call between two 2500 sets. Please refer to *Capacity Engineering* (NTP 553-3001-149 for further information).

Specifications

This section lists electrical, environmental, and Electro-Magnetic Containment(EMC) requirements of the ITG Line 2.0 card and the i2004 Internet Telephone.

i2004 Internet Telephone power requirements

The i2004 Internet Telephone is powered by a 16 V ac, 500 mA from a local transformer. Line voltage is different for each country. The i2004 Internet Telephone also accommodates a 48 V dc supply. Power is applied by a “barrel” connector.

The NTEX00BA ships with a transformer. The NTEX00BB does not include a transformer. You must order an NTxxxxxx transformer, depending on the country.

ITG Line card power consumption

The worst case current drawn by the ITG Line 2.0 card from each Backplane voltage supply is:

$$\pm 15 \text{ volt} = 19.3 \text{ watts} \Rightarrow 0.640 \text{ amps}$$

$$+5 \text{ volt} = 10.5 \text{ watts} \Rightarrow 2.1 \text{ amps}$$

Environmental specifications

Table 7 shows the environmental specifications of the ITG Line 2.0 card. The ITG line card provides external interface protection to -52 V dc, but does not provide lightning or hazardous voltage protection. Table 8 shows the environmental specifications of the i2004 Internet Telephone.

Table 7
ITG Line 2.0 card—environmental specifications

Parameter	Specifications
Operating temperature	0° to +60° C (+32 to +140° F), ambient
Operating humidity	5 to 95% RH (non-condensing)
Storage temperature	-40° to +70° C (-40° to +158° F)

Table 8
i2004 Internet Telephone—environmental specifications

Parameter	Specifications
Operating temperature	-20° to +50° C, ambient
Operating humidity	+30° / 95% RH (29 g/m3 mean absolute humidity)
Storage temperature	-40° to +70° C

Electromagnetic Compatibility requirements

Electro-Magnetic Containment (EMC) compliance requirements depend on the regulations in effect for the country where the Meridian 1 is located. CISPR 22 Class B defines more stringent EMC limits than CISPR 22 Class A requirements (that is, equipment that meets CISPR 22 Class B exceeds CISPR 22 Class A requirements and can be used globally).

The ITG 2.0 Line card is approved for CISPR 22 Class A (and FCC Part 15 Class A) limits and approved to CISPR 22 Class B limits.

IP address requirements for the Line 2.0 card

This section describes the IP address requirements for each node, for each card, and for each i2004 Internet Telephone.

A node is a group of ITG Line 2.0 cards. Each card within a node has two IP addresses - one for the voice LAN (T-LAN or C-LAN) and one for the management LAN (E-LAN). Each node has one Node IP address, on the T-LAN, which is dynamically assigned to the connection server on the node master. The i2004 Internet Telephone uses the Node IP address during the registration process.

All E-LAN addresses for all nodes must be on one subnet, including the Meridian 1 subnet. All E-LAN addresses must be on the same subnet as the Meridian 1 Core E-LAN. All T-LAN addresses must be in the same subnet for a given node.

Node IP requirements

The default setting of separate subnets offers the following features:

- Separate subnets are easier to configure
- Separate subnets protect the Meridian 1 from general LAN traffic, including broadcast storms
- Separate subnets are more secure

Note: Nortel Networks strongly recommends using separate subnets with the ITG Line 2.0/i2004.

Separate subnet Node IP address requirements

Figure 4 on page 45 shows an example of the ITG Node General tab with IP addresses configured for separate subnets. Nortel Networks recommends that you accept the default configuration of separate subnets. The terms in the bullet list below are the terms used to define the fields in the MAT/OTM application. If you select the recommended default configuration of separate subnets for voice LAN and management LAN, you require:

- Voice LAN Node IP address - The Voice LAN is sometimes called the Telephony LAN (T-LAN). This dynamic address appears as an IP on one of the T-LAN ports of one card in the node, or C-LAN (Customer LAN).

- Management LAN gateway IP address - The Management LAN is sometimes called the Embedded LAN (E-LAN)
- Management LAN subnet mask
- Voice LAN subnet mask

Figure 4
Node IP address requirements example (separate subnets)

The screenshot shows the 'New ITG Node' configuration window with the 'General' tab selected. The 'Node Location' section includes fields for MAT site (Sample Site), MAT system (Sample System), Customer (0), Node number (123), and Type (Meridian 1 - ITC). The 'Network Connections' section has a checkbox 'Use separate subnets for voice and management' which is checked. Below this, the Management LAN Node IP is 192.168.20.10, Management LAN gateway IP is 192.168.10.1, Management LAN subnet mask is 255.255.255.0, and Voice LAN subnet mask is 255.255.255.0. At the bottom, there are buttons for OK, Cancel, Apply, and Help.

Single subnet Node IP address requirements

Note: Nortel Networks strongly recommends using separate subnets with the ITG Line 2.0/i2004.

Figure 5 on page 46 shows an example of the ITG Node General tab with IP addresses configured for separate subnets. If you choose a single subnet for voice and management, all ITG Line 2.0 Node messages use the E-LAN. If you choose to implement the non-recommended option of separate subnets for voice and management, you require:

- Management LAN Node IP address
- Management LAN gateway IP address

- Management subnet mask addressE-LAN

Figure 5
Node IP address requirements example (single subnet)

The screenshot shows a 'New ITG Node' configuration window with the following details:

- General Tab:** Includes fields for MAT site (Sample Site), MAT system (Sample System), Customer (0), Node number (123), and Type (Meridian 1 - 61C).
- Network Connections:** Includes a checkbox for 'Use separate subnets for voice and management' (unchecked) and IP address fields for Management LAN Node IP (192.168.20.10), Management LAN gateway IP (192.168.10.1), Management LAN subnet mask (255.255.255.0), and Voice LAN subnet mask (255.255.255.0).
- Status Fields:** Last modified, Last downloaded, and Node sync status.
- Comments:** A text area for additional notes.
- Buttons:** OK, Cancel, Apply, and Help.

ITG Line card IP address requirements

The IP address information for each card is set in the **Configuration** tab of the ITG IP Phones application. The IP address requirements for each card depend on the Node subnet option.

You must provide an IP address for an E-LAN and T-LAN port. On the E-LAN, all cards must be on same subnet, which is the same subnet the Meridian 1 is connected to. On the T-LAN, all cards in a node must be on the same subnet.

The Management MAC is set in the factory. Use the MOTHERBOARD Ethernet address (E-LAN address) on the faceplate sticker on each ITG Line 2.0 card.

Separate subnet ITG Line 2.0 card IP address requirements

If you use separate subnets for the ITG Line 2.0 Node (see Figure 6 on page 48), each ITG Line 2.0 card requires a:

- Management IP address
- Voice IP address
- Management MAC
- Voice LAN gateway IP address

Single subnet ITG Line 2.0 card IP address requirements

Figure 7 on page 49 shows an example of the ITG Node Configuration tab with IP addresses configured for a single subnet. Because all messages use the Management LAN, the fields for Voice LAN are greyed-out. If you use a single subnet for the ITG Line 2.0 Node, each ITG Line 2.0 card requires a:

- Management IP address
- Management MAC

Figure 6
Separate subnet node configuration example

New ITG Node

General | Configuration | DSP Profile | SNMP Traps/Routing and IPs | Ports | Security

Define the list of cards for this node. To create the list, enter the values and click Add. Select a card in the list for change, or delete.

Card properties

Card role: **Leader0** Card IN: **4 -1-12**

Management IP: **192.168.10.2**

Management MAC: **00-60-38-01-12-77**

Voice IP: **192.168.20.2**

Voice LAN gateway IP: **192.168.20.1**

Sync status: New

Card role	Management IP	MAC address	Voice IP	Voice LAN gateway...	Card TN
Leader0	192.168.10.2	00:60:38:01:12:77	192.168.20.2	192.168.20.1	4 1 12

OK Cancel Apply Help

i2004 Internet Telephone IP address requirements

Each i2004 Internet Telephone requires an IP address. The i2004 Internet Telephone also requires information about subnet masks, IP default gateway (router) for the i2004 Internet Telephone LAN segment and other network configuration parameters. See “Requested Network Configuration Parameters” on page 102 for detailed information on i2004 Internet Telephone network address requirements and related network parameters.

Figure 7
Single subnet node configuration

New ITG Node

General Configuration DSP Profile SNMP Traps/Routing and IPs Ports Security

Define the list of cards for this node. To create the list, enter the values and click Add. Select a card in the list for change, or delete.

Card properties

Card role: **Leader0** Card IN: **4 -1-12**

Management IP: **192.168.10.2**

Management MAC: **00-60-38-01-12-77**

Voice IP: **192.168.20.2**

Voice LAN gateway IP: **192.168.20.1**

Sync status: New

Add Change Delete Host Names

Card role	Management IP	MAC address	Voice IP	Voice LAN gateway...	Card TN
Leader0	192.168.10.2	00:60:38:01:12:77	192.168.20.2	192.168.20.1	4 1 12

OK Cancel Apply Help

Equipment considerations

This section lists optional and required equipment that can be used to install, configure, and maintain the ITG Line 2.0 card and i2004 Internet Telephone products.

Optional equipment

- A server configured with Dynamic Host Configuration Protocol (DHCP). For example, you can use a Nortel NetID server.
- External modem router (recommended Bay Networks Netgear RM356) to allow remote dial-up connection to E-LAN for technical support.

Required equipment

- PC with MAT version 6.67.07 (with update disk)/ OTM 1.0 (or later) installed. Turn to “ITG MAT 6.67.07 (with update disk)/OTM 1.0 management PC” on page 159 for MAT PC configuration information.
- Local TTY or terminal in switchroom - required for leader 0 configuration
- Shielded CAT 5 Ethernet cables to connect ITG Line 2.0 card to external hub equipment
- 10/100-Base-T Ethernet port (optional auto-sensing) to support T-LAN and E-LAN network connections
- 10/100-Base-T Ethernet port (optional auto-sensing) in each location an i2004 Internet Telephone resides.
- Serial cables

Filter connectors

For Meridian 1 large systems, the standard filtering is provided by the 50-Pin filter connectors mounted in the I/O Panel on the back of the IPE shelf. The filter connector connects externally to the MDF cables and internally to the NT8D81AA Backplane to I/O Panel ribbon cable assembly. All Tip and Ring pairs, including the T-LAN pairs, are filtered within the connector. For 100BaseT operation, the standard connector must be replaced with the NTCW84JA connector which is identical to the existing connector but has unfiltered T-LAN Tip and Ring pairs.

For Option 11C or 11C MiniC systems, the standard I/O filter connector already supports 100BaseTX. Refer to “Install NTCW84JA Large System ITG-specific I/O Panel Filter Connector” on page 115 for installation instructions.

CAUTION

For Meridian 1 large systems manufactured during the period of 1998-1999 and shipped in North America, the IPE modules have the NT8D81BA Backplane to I/O Panel ribbon cable assembly with a non-removable Filter Connector. The NT8D81BA is compatible with 10BaseT T-LAN, but if you require a 100 BaseT T-LAN, you need to order and install the NT8D81AA Backplane to I/O Panel ribbon cable assembly. **Do not** try to install the NTCW84JA Filter Connector onto the existing non-removable Filter Connector.

If required for your site, turn to See “Replace cable NT8D81BA with NT8D81AA” on page 243.

Identify the IPE card slots

Identify the IPE card slots selected for ITG Line 2.0 card.

Table 9
ITG installation by module type

Meridian 1 Modules	ITG Card Slots
NT8D37BA/EC IPE modules, NT8D11BC/ED CE/PE modules	All available IPE card slots.
NT8D37AA/DC IPE modules	0, 4, 8, and 12
NT8D11AC/DC CE/PE modules	0

Product compatibility with other ITG products

Nortel Networks manufactures three Voice Over IP (VoIP) products in addition to ITG Line 2.0. This section explains how the ITG Line 2.0 card relates to the ITG products listed below:

- Meridian Internet Telephony Gateway Line 1.0 card/IP Telecommuter
- Meridian Internet Telephony Gateway Trunk 1.0 card/Basic per-trunk signaling
- Meridian Internet Telephony Gateway Trunk 2.0 card/ISDN Signaling Link

All cards within a node must be on the same subnet. Each ITG product uses T-LANs and E-LANs that can co-exist with each other. All cards within a node must be on the same subnet. They can share the same T-LANs, and must share the same E-LAN. You need to engineer the traffic on the T-LAN to consider all ITG applications.

For EMC compliance, add up all the ITG products to stay within EMC limits. The ITG cards all require two slots in a module or cabinet.

Meridian IP Telecommuter is an H.232 application and requires a separate line card. All ITG applications require their own card.

Virtual superloops, virtual TNs and physical TNs

Virtual TNs allow configuration of service data on a terminal, such as key layout and class of service, without requiring the i2004 Internet Telephone physical terminal to be directly connected (hard-wired) to the Meridian 1 XDLC line card. Calls are made between an i2004 Internet Telephone and traditional sets/trunks using the full Meridian 1 feature set. DSP channels are allocated dynamically for this type of call to perform the transcoding required to connect the i2004 Internet Telephone to the TDM network.

A new type of superloop (a virtual superloop) is introduced by the i2004 Internet Telephone to support i2004 Internet Telephone configuration. To create i2004 Internet Telephones through the use of VTNs, you must create a virtual superloop in Overlay 97. Up to 1024 VTNs can be configured on a single virtual superloop for a large system. Up to 128 VTNs can be configured on a single virtual superloop for a small system, leading to a maximum number of 640 VTNs per system.

Each ITG Line 2.0 card requires 24 physical TNs. You configure the physical units in Overlay 14.

ITG card CPU resources

The i2004 Internet Telephones share the CPU resources of the ITG cards. Each i2004 Internet Telephone is controlled by one of the ITG Line 2.0 cards. Up to 96 i2004 Internet Telephones can be registered with a single ITG card.

i2004 Internet Telephones can call other i2004 Internet Telephones like any other telephone on the Meridian 1. In i2004 to i2004 calls, the voice media stream is carried by IP packets directly between the sets over the IP network.

On a traditional telephone, the tones are generated by Meridian 1. The i2004 Internet Telephone can generate tones that originate on the original switch, so the tones do not suffer from distortion caused by IP network compression.

Codecs

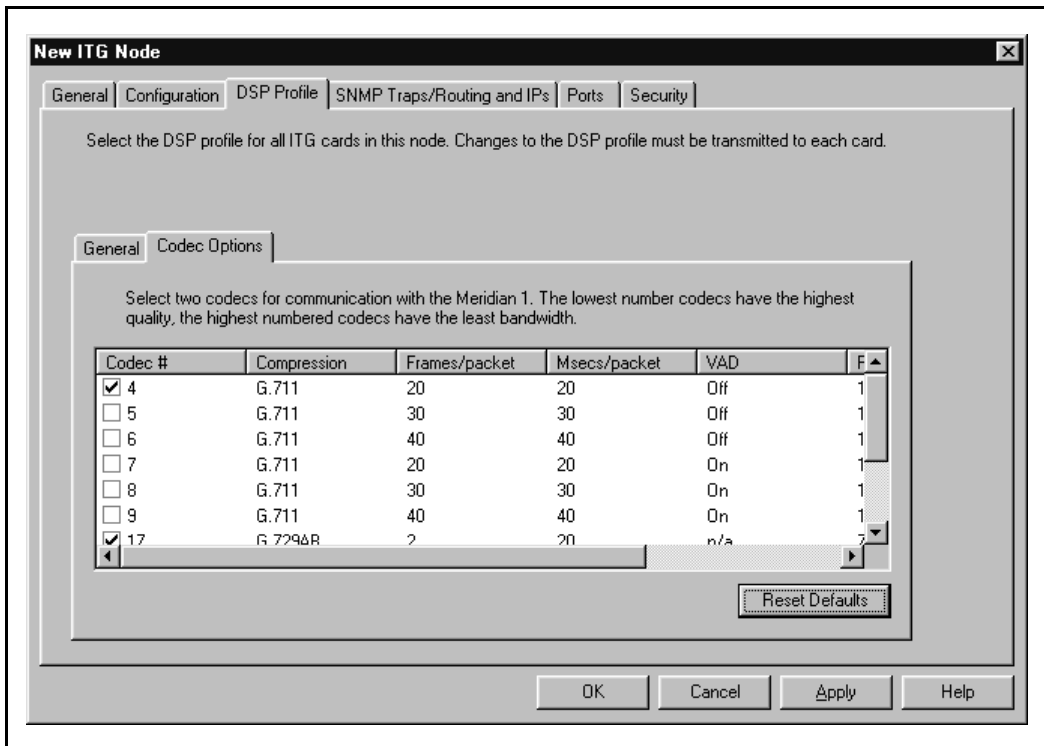
The i2004 Internet Telephone and ITG Line 2.0 card support different codecs and codec parameters with different compression rates and audio quality. The Meridian 1 selects the appropriate codecs based on user-configurable parameters. For instance, within a LAN an i2004 Internet Telephone-to-i2004 Internet Telephone call can be set up using G.711 at 64 Kbps. For an i2004 Internet Telephone-to-i2004 Internet Telephone call over a WAN, the call can be set up using G.729B at 8 Kbps.

The Terminal Proxy Server (TPS) and Meridian 1 have a predefined table of up to 32 codecs that can be supported. The first entry in the table has the highest quality audio and requires the largest bandwidth. The last entry requires the least bandwidth, with some qualifications.

When an i2004 Internet Telephone or gateway DSP comes on-line, it determines which of the codecs it supports. This information is provided to the Meridian 1 as part of the i2004 Internet Telephone registration sequence. For more information about the registration sequence, turn to “Configuration of the DHCP server” on page 97. The Meridian 1 uses this information to set up a speech path to select a Codec that both endpoints support. As part of zone management, it further selects the Codec based on whether it is trying to optimize quality or bandwidth.

When you configure the ITG Line 2.0 card, you select two codecs - a high-quality Codec and a bandwidth-efficient Codec. Figure 8 on page 54 shows the list of supported codecs. The ITG Line 2.0 product supports A-law and Mu-law.

Figure 8
Codec Options (default selection)



IP Network engineering guidelines

Contents

This section contains information on the following topics:

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Overview

This chapter provides guidelines and recommendations to help plan, engineer, and test the ITG Line 2.0 card/i2004 Internet Telephone network.

See “Configuration of the DHCP server” on page 97, for engineering guidelines to set and configure the Dynamic Host Configuration Protocol (DHCP) server to support the ITG Line 2.0 card and i2004 Internet Telephone.

IP network assessment procedure

An efficient ITG network design begins with an understanding of traffic and the underlying network that transmits the traffic. The following procedure summarized the steps the technician must perform to determine the network requirements of the specific system.

Procedure 1

Network assessment procedure

- 1 Estimate the amount of traffic that the Meridian 1 will process via the ITG network. See “Calculate ITG traffic requirements” on page 57.
- 2 Assess whether the existing corporate intranet can adequately support voice services. See “Assess WAN link resources” on page 62.
- 3 Organize the ITG network into “zones” representing different topographical areas of the network that are separated according to bandwidth considerations. See “IP Voice zones” on page 64.
- 4 Set a variety of service parameters to improve service and coordinate (with the IP administrator) the prioritization of voice packets with data traffic. See “Set service parameters” on page 69.
- 5 Decide to use separate subnets, or a single subnet, to carry voice and management traffic. See “Separate subnet configuration” on page 86.

- 6** Provide the necessary IP network infrastructure:
- 10baseT or 100baseT Ethernet connection.
 - IP address. Each ITG Line 2.0 card requires 10baseT E-LAN or 10/100baseT T-LAN unicast IP address.
 - One additional IP address per node. The node IP address will be on the T-LAN if using separate subnets or on the E-LAN if using a single subnet.

————— *End of Procedure* —————

After completing the network assessments, the technician can design and implement the ITG network. This can involve modifications to both the ITG elements and to the existing network. Post-installation network measurements (page 85) must be made on a regular basis to make sure QOS standards are maintained. Figure 9 shows an example of the T-LAN and E-LAN topology.

Calculate ITG traffic requirements

The technician must forecast the CCS traffic that the Meridian 1 will process via the ITG network. CCS traffic generated by an i2004 Internet Telephone is typically similar to that of a digital telephone. The following procedures calculate the bandwidth required to support given amounts of traffic.

The procedures require the following data:

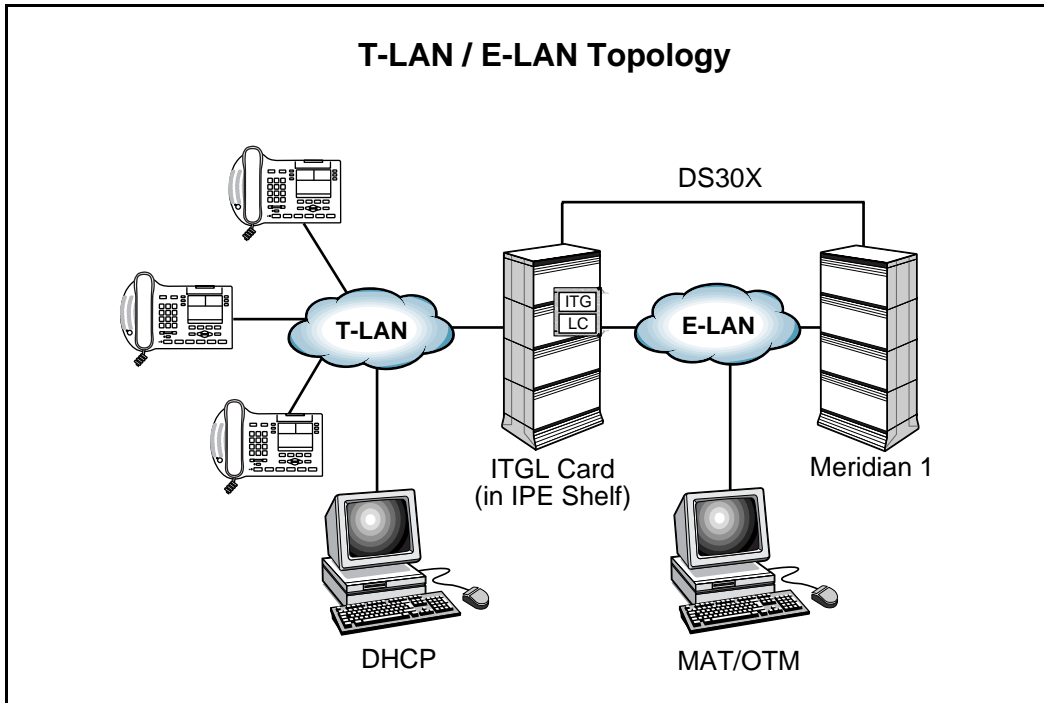
- CCS/i2004 Internet Telephone
- Number of i2004 Internet Telephones
- Number of subnets/servers accessed by i2004 Internet Telephones

Note: Base all traffic data on busy hour requirements.

The result of the calculation will provide estimated values for the following:

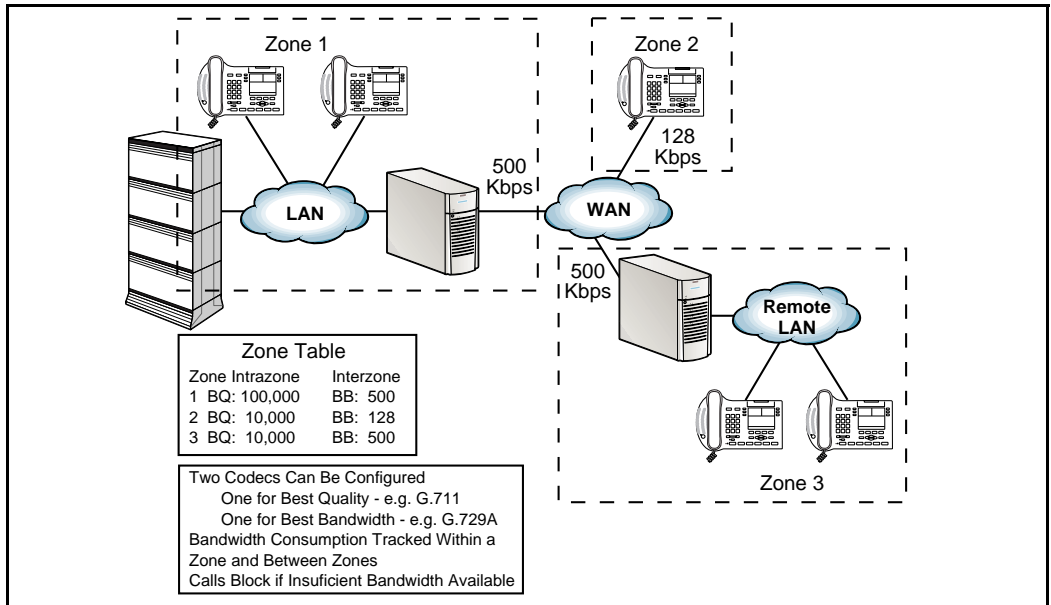
- Total T-LAN bandwidth requirement
- WAN bandwidth requirement per subnet or server/router

Figure 9
T-LAN and E-LAN Topology



For a more thorough assessment, the technician must consider the impact of incremental ITG Line 2.0 traffic on routers and LAN resources in the intranet. LAN segments can become saturated, and routers can experience high CPU utilization. A customer should consider re-routing scenarios in a case where a link is down. Figure 10 shows an example of bandwidth management.

Figure 10
Bandwidth management example



T-LAN traffic calculations

To calculate the total T-LAN requirement, add together all sources of traffic destined for the IP telephony network using the same LAN. The data rate for a T-LAN is the total bit rate.

Procedure 2

T-LAN traffic calculation procedure

- 1 Total subnet traffic = Number of i2004 Internet Telephones \times CCS/i2004 Internet Telephone.
- 2 Convert to erlangs: total CCS / 36.
- 3 Find T-LAN bandwidth usage (kbit/s) from Table 10.
Note: Table 10 lists the Ethernet and WAN bandwidth usage of IP Line ports with the 729AB codec only.
- 4 Bandwidth per subnet = total erlangs \times T-LAN bandwidth usage.
- 5 Repeat the procedure for each subnet.
- 6 Sum up total T-LAN bandwidth usage.
- 7 ITG cards = total i2004 Internet Telephones / 24.

————— *End of Procedure* —————

Table 10
T-LAN and WAN IP bandwidth usage per ITG Line 2.0 card port
(silence suppression enabled)

Codec type	Frame duration payload (ms)	Voice payload (bytes)	IP packet (bytes)	Ethernet frame (bytes)	T-LAN bandwidth usage (simplex) (kbit/s)	WAN bandwidth usage (duplex) (kbit/s)
G.711 (64 kbit/s)	10	80	120	146	116.8	48
	20	160	200	226	90.4	40
	30	240	280	306	81.6	37.3
G.729AB G.729A (8 kbit/s)	10	10	50	76	60.8	20
	20	20	60	86	34.4	12
	30	30	70	96	25.6	9.3
<p>Note 1: T-LAN data rate is the effective Ethernet bandwidth consumption.</p> <p>Note 2: T-LAN kbps = Ethernet frame bytes \times 8 \times 1000/Frame duration in ms</p> <p>Note 3: WAN kbps = IP packet bytes \times 8 \times 1000/frame duration in ms/2.</p> <p>Note 4: 50% voice traffic reduction due to silence suppression.</p> <p>Note 5: Overhead (RTP/UDP header + IP header) of packets over the voice payload multiframe is 40 bytes; overhead of Ethernet frame over IP packet is 26 bytes.</p> <p>Note 6: Ethernet bandwidth must be set aside to support an Interframe gap of at least 12 bytes per frame. This gap is not included in the above bandwidth calculation.</p> <p>Note 7: The interframe gap of 12 bytes is not included in the above bandwidth calculation, because of the low probability of occurring in this type of application.</p>						

T-LAN engineering example

- 1 Subnet A: 36 i2004 Internet Telephones, average 6 CCS/i2004 Internet Telephone.
- 2 Subnet A total erlangs = $36 \times 6 / 36 = 6$
- 3 For G. 729 Annex AB with silence suppression, T-LAN bandwidth usage is 25.6 kbit/s.
- 4 Subnet A bandwidth = $6 \times 25.6 = 153.6$

- 5 Subnet B: 72 i2004 Internet Telephones, average 5 CCS/i2004 Internet Telephone.
Subnet B total erlangs = $72 \times 5 / 36 = 10$
Subnet B bandwidth = $10 \times 25.6 = 256$
Subnet C: 12 i2004 Internet Telephones, average 6 CCS/i2004 Internet Telephone.
Subnet C total erlangs = $12 \times 6 / 36 = 2$
Subnet C bandwidth = $2 \times 25.6 = 51.2$
- 6 T-LAN Bandwidth = $153.6 + 256 + 51.2 = 460.8$ kbps
- 7 Number of ITG Line 2.0 cards = $(36 + 72 + 12) / 24 = 5$

Assess WAN link resources

If ITG traffic routed over intranet WAN links, the technician must assess the status of those links. WAN links are often the source of network capacity problems. For a locally connected i2004 telephone, if calls are routed to the PSTN, the calls will impact the capacity of the T-LAN only.

When calls are routed through an intranet, WAN links are frequently the source of capacity problems in the network. Unlike LAN bandwidth, which is virtually free and easily implemented, WAN links typically take time to obtain financial approval, provision, and upgrade. For these reasons, it is important to assess the state of WAN links in the intranet prior to implementing the ITG network.

WAN traffic calculations

For data rate requirements for the intranet route, calculation is based on duplex channels. The data rate for a WAN is the duplex data rate. For example, 120 Kbps on the LAN is equal to a 64 Kbps duplex channel on the WAN.

Procedure 3

WAN traffic calculation procedure

- 1 Total subnet traffic = number of i2004 Internet Telephones \times CCS/i2004 Internet Telephone.
- 2 Convert to erlangs: total CCS / 36.

- 3 Find WAN bandwidth usage (kbit/s) from Table 10.
Note: Table 10 on page 61 lists the Ethernet and WAN bandwidth usage of IP Line ports with the 729AB codec only.
 - 4 Bandwidth per subnet = total erlangs \times WAN bandwidth usage.
 - 5 Multiply bandwidth per subnet \times 1.3 to adjust for traffic peaking.
 - 6 Repeat the procedure for each subnet.
 - 7 Adjust WAN bandwidth to account for WAN overhead depending on WAN technology used:
 - ATM (AAL1): multiply subnet bandwidth \times 1.20 (9 bytes overhead/44 bytes payload)
 - ATM (AAL5): multiply subnet bandwidth \times 1.13 (6 bytes overhead/47 bytes payload)
 - Frame Relay: multiply subnet bandwidth \times 1.20 (6 bytes overhead/30 bytes payload -- variable payload up to 4096 bytes)
- Note:** Each WAN link should be engineered to be no more than 80% of its total bandwidth if the bandwidth is 1536 kbps or higher (T1 rate); if the rate is lower, up to 50% loading on the WAN is recommended.

————— *End of Procedure* —————

WAN engineering example

- 1 Subnet A: 36 i2004 Internet Telephones, average 6 CCS/i2004 Internet Telephone.
- 2 Total erlangs = $36 \times 6 / 36 = 6$
- 3 For G. 729 Annex AB with silence suppression, WAN bandwidth usage is 9.3 kbit/s.
- 4 Subnet A WAN bandwidth = $9.3 \times 6 = 55.8$ kbps
- 5 Subnet A WAN bandwidth with 30% peaking = $55.8 \times 1.3 = 72.54$ kbit/s.
- 6 Subnet B: 72 i2004 Internet Telephones, average 5 CCS/i2004 Internet Telephone.
 - Total erlangs = $72 \times 5/36 = 10$
 - Subnet B WAN bandwidth = $9.3 \times 10 = 93$ kbps

- Subnet B WAN bandwidth with 30% peaking = $93 \times 1.3 = 120.9$ kbit/s.
 - Subnet C: 12 i2004 Internet Telephones, average 6 CCS/i2004 Internet Telephone.
 - Total erlangs = $12 \times 6/36 = 2$
 - Subnet C WAN bandwidth = $9.3 \times 2 = 18.6$ kbps
 - Subnet C WAN bandwidth with 30% peaking = $18.6 \times 1.3 = 24.18$ kbit/s.
- 7 If the WAN is known to be an ATM network (AAL1), the estimated bandwidth requirements are:
- Subnet A WAN bandwidth with ATM overhead = $72.54 \times 1.2 = 87.0$ kbps.
 - Subnet B WAN bandwidth with ATM overhead = $120.9 \times 1.2 = 145.1$ kbps.
 - Subnet C WAN bandwidth with ATM overhead = $24.18 \times 1.2 = 29.0$ kbps.

————— *End of Procedure* —————

IP Voice zones

Each i2004 Internet Telephone and ITG port is assigned a zone number in which they reside. The zone indicates the bandwidth management zone of the IP devices so that IP bandwidth within locations, and between locations, can be managed. This allows users to avoid quality degradation due to insufficient bandwidth for active connections.

For example, a branch office or telecommuter location can have more i2004 Internet Telephones than are supported by the IP link to that location (for example, 128 Kbps bandwidth with 10 i2004 Internet Telephones).

The zones are also used to determine whether voice compression and silence detection is used for a connection.

Zone properties are defined in Overlay 117. Up to 256 zones can be configured. The Audio Connection Proxy uses the zones for bandwidth management. Each zone has four parameters. The prompt lists the parameters as p1, p2, p3 and p4:

- p1 - Total bandwidth available for intrazone calls

- p2 - The preferred strategy for the choice of codec for intrazone calls (that is, preserve voice quality or preserve bandwidth)
- p3 - The total bandwidth available for interzone calls
- p4 - The preferred strategy for the choice of the codec for interzone calls

If no IP voice zones are configured, zone 0 operates as a default zone with no restrictions on bandwidth usage. However, if any zones are configured, zone 0 must also be configured if it is referenced by any i2004 Internet Telephones or ITG Line 2.0 TNs.

IMPORTANT

When moving an i2004 Internet telephone, the Meridian 1 Administrator must change the zone assignment in Overlay 11. See “X11 Input/output Guide”, NTP 553-3001-511.

Relationship between zones and domains

Link utilization assessment

Procedure 4

Link utilization assessment procedure

- 1 Obtain a current topology map and link utilization report of the intranet.
- 2 Visually inspect the topology map to reveal which WAN links are likely to be used to deliver ITG traffic. Alternately use the traceroute tool (see “Measuring tools” on page 70).
- 3 Find out the current utilization of the WAN links. For example, the link utilization may be averaged over a week, a day, or an hour.
- 4 Obtain the busy period (peak hour) utilization of the link.
- 5 Also, because WAN links are full-duplex and data services exhibit asymmetric traffic behavior, obtain the utilization of the link representing traffic flowing in the heavier direction.

- 6 Assess how much spare capacity is available.

Enterprise intranets are subject to capacity planning policies that ensure that capacity usage remains below some determined utilization level.

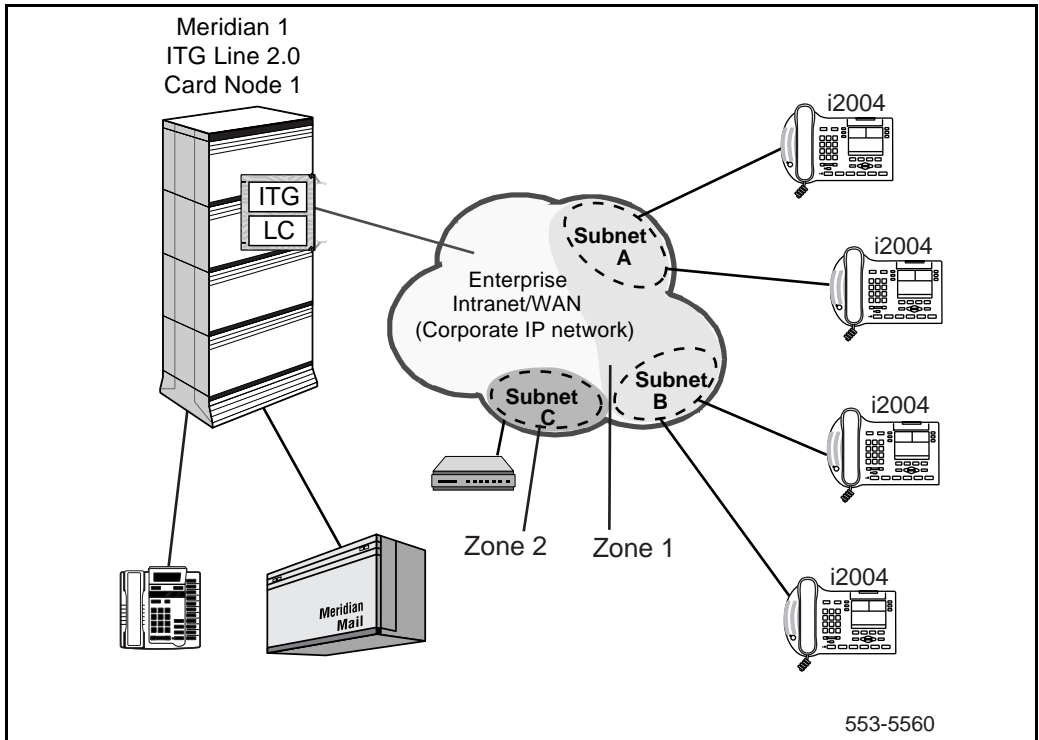
For example, a planning policy might state that the utilization of a 56 kbps link during the peak hour must not exceed 50%; for a T1 link, the threshold is higher, perhaps 80%. The carrying capacity of the 56 kbps link would be 28 kbps, and for the T1 1.2288 Mbps. In some organizations the thresholds may be lower than that used in this example; in the event of link failures, there needs to be spare capacity for traffic to be re-routed.

- 7 The difference between the current capacity, and its allowable limit, is the available capacity.

For example, a T1 link utilized at 48% during the peak hour, with a planning limit of 80% would have an available capacity of about 492 kbps.

————— *End of Procedure* —————

Figure 11
An ITG intranet with subnetworks



Estimating network loading due to ITG traffic

At this point, the technician has enough information to “load” the ITG traffic on the intranet. The following example illustrates how this is done on an individual link.

Example:

Suppose the intranet has a topology as shown in Figure 11 on page 67, and the technician wants to predict the amount of traffic between the ITG node and corporate intranet. From the Calculate ITG traffic requirements section (on page 57) and traceroute measurements, traffic between the ITG node and subnet A, the ITG node and subnet B, and the ITG node and Router/Server C are collected.

To complete this example, the traffic flow from the ITG node to all routes needs to be summed to determine the load to the link (T-LAN).

Decision: Sufficient capacity?

A link is defined as the route between the ITG Line 2.0 card node and a subnet. Table 11 organizes the computations so that for each link, the available link capacity can be compared against the additional ITG Line 2.0 card load. For example, on the link from the ITG Line 2.0 card Node to Subnet C, there is plenty of available capacity (568 kbps) to accommodate the additional 24 kbps of ITG Line 2.0 card traffic.

Table 11
Link Utilization Summary Example

Link		Utilization (%)		Available capacity (kbps)	Incremental ITG load Traffic (kbps)	Sufficient capacity?
End-points	Capacity (kbps)	Threshold	Used			
ITG_Node1 - SubnetA	1536	80	75	76.8	72.5	Yes
ITG_Node1 - SubnetB	1536	80	50	460.8	120.9	Yes
ITG_Node1 - SubnetC	1536	80	48	492	24.2	Yes
....

Some network management systems have network planning modules that compute network flows in the manner just described. These modules provide more detailed and accurate analysis as they can take into account actual node, link, and routing information. They also help the technician assess network resilience by conducting link and node failure analysis. By simulating failures, re-loading network and re-computed routes, the modules indicate where the network could run out of capacity during failures.

Insufficient link capacity

If there is insufficient link capacity, consider upgrading the link's bandwidth.

Set service parameters

Quality of Service (QOS) mechanism

QOS is controlled by setting the DiffServ field in the IP header for both the ITG Line Card and the i2004 Internet Telephone. This can be set to a value between 0 and 255 using MAT 6.6/OTM 1.0. The default value is 0.

If DiffServ is implemented on the network, this value must be set by the IP Network Administrator. A typical value is 184 (10111000 binary) (B8 hex), which is the expedited forwarding (EF) code point value. The value is set once per system and applies to all packets being sent by the card. The value is also downloaded to all sets.

In some cases the IP Network Administrator can set the DiffServ field at the edge of the QOS-controlled network by routers at the network edge. DiffServ can be set based on source or destination address, or port number. The ITG Line 2.0 and i2004 Internet Telephone can be configured to have audio and signaling port numbers in a specific range.

There is a potential to degrade the voice quality if codecs are cascaded. This can occur when there are multiple compression and decompression stages on a voice call. The more IP links utilized in a call, the more delay is added, and therefore the greater the impact on the voice quality. The following lists a few applications and devices which can impact voice quality:

- Voice Mail, for example, NMS, introduces another stage of compression and decompression
- Conferences can double the number of IP links
- ITG Trunks can add additional stages of compression and decompression

To ensure optimal voice quality, it is recommended to minimize the number of compression and decompression stages and wherever bandwidth permits, use G.711 codec.

Measure intranet Quality of Service

Utilization of the existing data network must be assessed to determine the quality of voice services it can support.

End-to-end delay and error characteristics of the intranet must be measured so that the technician can set realistic QOS expectations for intranet voice services.

The use of measuring tools requires a starting node and a destination node. The starting node can be a “PING” (see page 70) host on a LAN segment attached to the router intended to support the ITG Line 2.0 card node. The destination node can be a remote subnet. The requirement is briefly described as follows.

Note: Make sure that the ITG network TOS/DiffServe bytes are set to their intended operational values before taking measurements.

Criteria

- **End-to-end packet delay:** Packet delay is the point to point one-way delay between the time a packet is sent to the time it is received at the remote end. It is comprised of delays at the ITG node and WAN route. To minimize delays, the ITG node should be located to minimize the number of hops to the network backbone, or WAN.
Note: To assure a good voice quality, the end-to-end delay is recommended to be ≤ 50 ms.
- **End-to-end packet loss:** Packet loss is the percentage of packets sent that do not arrive at their destination. Transmission equipment problems, packet delay, and network congestion cause packet loss. In voice conversation, packet loss appears as gaps in the conversation. Sporadic loss of small packets can be more tolerable than infrequent loss of large packets.

Note: For high quality voice transmission, a packet loss of $\leq 2\%$ is recommended.

Measuring tools

- PING (Packet Internet Groper)
- Traceroute

Both PING and traceroute are basic measuring tools that can be used to assess the ITG network. They are standard utilities that come with most commercial operating systems. PING is used to measure the round trip delay of a packet and the percentage of packet loss; while traceroute breaks down delay segments of a source-destination pair and any hops in-between.

There are several third party applications that perform data collection similar to the way PING and traceroute do. In addition, these programs also analyze data and plot performance charts. Using PING/traceroute to collect data for manual analysis is more labor intensive, however, the information provided by these basic tools is just as useful as the more sophisticated applications.

The following analysis will use PING/traceroute data for discussion, although it is likely in most situations a third party application will be used.

Destination Types

To a Remote Subnet

This configuration involves an intranet subnet that is attached to a number of i2004 Internet Telephones, which serves as a hub for delivering voice packets between the i2004 Internet Telephone and the ITG network. Collect the delay measurement between the PING host and the subnet server.

Measuring end-to-end network delay

The basic tool used in ITG networks to measure end-to-end network delay is the PING program. PING takes a delay sample by sending an ICMP packet from the host of the PING program to a destination server, and waits for the packet to make a round trip.

To ensure the delay sample results are representative of the ITG_node1:

- a** attach the PING host to a “healthy” LAN segment.
- b** attach the LAN segment to the router intended to support the ITG Line 2.0 card node.
- c** choose a destination host by following the same critical guidelines as for the source host.

The size of the PING packets can be any number; the default is 60 bytes.

Sample PING output:

```
ITG_Node1% PING -s subnetA 60

PING subnetA (10.3.2.7): 60 data bytes

68 bytes from (10.3.2.7): icmp_seq=0 ttl=225
time=97ms

68 bytes from (10.3.2.7): icmp_seq=0 ttl=225
time=100ms

68 bytes from (10.3.2.7): icmp_seq=0 ttl=225
time=102ms

68 bytes from (10.3.2.7): icmp_seq=0 ttl=225
time=97ms

68 bytes from (10.3.2.7): icmp_seq=0 ttl=225
time=95ms

68 bytes from (10.3.2.7): icmp_seq=0 ttl=225
time=94ms

68 bytes from (10.3.2.7): icmp_seq=0 ttl=225
time=112ms

68 bytes from (10.3.2.7): icmp_seq=0 ttl=225
time=97ms

^?

--- ITG_Node1 PING Statistics ---

8 packets transmitted, 8 packets received, 0% packet
loss

round-trip (ms) min/avg/max = 94/96/112
```

----- ***End of Output*** -----

Assessment of sample PING output

Note: The round trip time (*rtt*) is indicated by the time field.

Notice the variation of *rtt* from the PING output. It is from repeated sampling of *rtt* that a delay characteristic of the intranet can be obtained. In order to obtain a delay distribution, the PING tool can be embedded in a script which controls the frequency of the PING probes, timestamps and stores the samples in a raw data file. The file can then be analyzed later using a spreadsheet or another application. The technician can also check whether the intranet's network management software has any delay measurement modules which can obtain a delay distribution for a specific route.

Delay characteristics vary depending on the site pair and the time-of-day. The "site pair" is defined as the measurement between the host ITG and the remote subnet (for example, ITG to subnet A in Figure 11 on page 67). The assessment of the intranet must include taking delay measurements for each ITG site pair. If there is significant variation of traffic in the intranet, it is best to include PING samples during the intranet's peak hour. For a more complete assessment of the intranet's delay characteristics, obtain PING measurements over a period of at least a week.

Measuring end-to-end packet loss

The PING program also reports whether the ICMP packet made its round trip successfully or not. Use the same PING host setup to measure end-to-end error, and, in making delay measurement, use the same packet size parameter.

Sampling error rate, however, requires taking multiple PING samples (at least 300 to be statistically significant), thus obtaining an error distribution requires running PING over a greater period of time. The error rate statistic collected by multiple PING samples is called packet loss rate (PLR).

Recording routes

Routing information for all source-destination pairs need to be recorded as part of the network assessment. This is done using the traceroute tool; an example of the output is shown below.

```
itg_node1% traceroute subnetA
```

```
traceroute to subnetA 10.3.2.7, 30 hops max, 32 byte packets
```

1	r6 (10.8.0.1)	1 ms	1 ms	1 ms
2	r5 (10.18.0.2)	42 ms	44 ms	38 ms
3	r4 (10.28.0.3)	78 ms	70 ms	81 ms
4	r1 (10.3.0.1)	92 ms	90 ms	101 ms
5	subnetA (10.3.2.7)	94 ms	97 ms	95 ms

The traceroute program can also be used to verify whether routing in the intranet is symmetric or not for each of the source-destination pairs. This can be done using the `-g` loose source routing option, as illustrated in the following command syntax:

```
itg_node1% traceroute -g subnetA itg_node1
```

Adjusting PING measurements

One-way vs. roundtrip

The PING statistics are based on round trip measurements, whereas the QOS metrics in the Transmission Rating model are one-way. Halve the delay and packet error PING statistics, to ensure the comparison is valid.

Adjustment due to ITG processing

The PING measurements are taken from PING host to PING host. The Transmission Rating QOS metrics are from end user to end user, and thus include components outside the intranet. The PING statistic for delay needs to be further modified by adding 93ms to account for the processing and jitter buffer delay of the ITG Line 2.0 card nodes.

Note: No adjustment needs to be made for error rates.

If the intranet measurement barely meets the round trip QOS objectives, the technician needs to be aware that there is a possibility that the one-way QOS is not met in one of the directions of flow. This can be true even if the flow is on a symmetric route due to asymmetric behavior of data processing services.

The high priority and low priority input buffers (HPIB) and low-priority input buffers (LPIB) need to be set to a value of 32 or greater.

Late packets

Packets that arrived outside of the window allowed by the jitter buffer are discarded by the ITG. To determine which PING samples to ignore, first calculate the average *one-way delay* based on all the samples.

To calculate late packets, double the value of the nominal jitter buffer setting. For example, assume:

- The average one way delay is 50 msec
- The jitter buffer is set to a nominal (or average) value of 40 msec
- Then the maximum value is $2 \times 40 + 50 = 130$ msec.

Therefore, any packet with a one way delay of greater than 130 msec is late, and must be added to the total number of packets lost.

A “site pair” is defined as the measurement between the host ITG and the remote subnet served by a server (for example, ITG to subnet A in Figure 11 on page 67).

Table 12 shows the way to record one way delay, packet loss, and expected QOS level for each site pair.

Table 12
QOS Measurements Summary

Site pair	Measured One way delay (ms)		Measured Packet loss (%)		Expected QOS level (see Table 13)	
	Mean	Mean+ σ	Mean	Mean+ σ	Mean	Mean+ σ
ITG_Node1/SubnetA	171	179	2	2.3	Excellent	Good
ITG_Node1/SubnetB	120	132	1.3	1.6	Excellent	Excellent
ITG_Node1/SubnetC	190	210	2.1	2.3	Good	Good
ITG_Node1/Router1	220	235	2.4	2.7	Good	Good
ITG_Node1/Router2	305	345	2.2	2.6	Good	Fair
ITG_Node1/Router3	260	286	2.4	2.8	Good	Fair

As an example, the site pair ITG_Node1 and SubnetA has the mean delay and average packet loss meeting “excellent” criteria, while with standard deviation, they satisfy only “good” QOS level.

At the end of this measurement and analysis, the technician has a good indication of whether or not the corporate intranet can deliver adequate voice service. Looking at the “Expected QOS level” column in Table 12 on page 75, the technician can gauge the QOS level for each site pair.

In order to offer good voice quality, the technician must keep the network Mean+ σ operating region within a “Good” or “Excellent” QOS level.

If the expected QOS levels of some or all routes fall short of being “Good”, the technician will need to evaluate the options and costs for upgrading the intranet. Using Table 13 data, the technician can estimate the amount of one-way delay or percentage packet loss that needs to be reduced to raise the QOS level.

If the decision is to keep costs down, and accept a “Fair” QOS level for a particular route, the technician should closely monitor the QOS level, reset expectations with the end users, and be receptive to user feedback to make changes.

Estimate QOS level

Use Table 13 to estimate the ITG QOS level based on QOS measurements of the intranet. To limit the size of this table, the packet loss and one-way delay values are tabulated in increments of 1% and 10ms respectively. The techniques used to determine and apply the information in this table are proprietary to Nortel Networks.

Table 13
ITG QOS levels (Part 1 of 4)

Packet loss (%)	One-way delay (ms)	QOS level		
		G.729A	G.711A/G.711u	G.723.1
0	50-200	excellent	excellent	excellent
0	210-220	excellent	excellent	good
0	230-330	good	excellent	good
0	340-360	good	good	good
0	370-380	good	good	fair
0	390-620	fair	good	fair
0	630-780	fair	fair	fair
0	790	fair	fair	poor
1	50-180	excellent	excellent	good
1	190-200	good	excellent	good
1	210-320	good	good	good
1	330-340	good	good	fair
Note: The QOS levels are equivalent to the following MOS values: <ul style="list-style-type: none"> • excellent 5 • good 4 • fair 3 • poor 2 				

Table 13
ITG QOS levels (Part 2 of 4)

Packet loss (%)	One-way delay (ms)	QOS level		
		G.729A	G.711A/G.711u	G.723.1
1	350-360	fair	good	fair
1	370-630	fair	fair	fair
1	640-690	fair	fair	poor
1	700-780	poor	fair	poor
2	50-270	good	good	good
2	280-300	good	good	fair
2	310-320	good	fair	fair
2	330-510	fair	fair	fair
2	520-580	fair	fair	poor
3	50-250	good	good	good
3	260	good	good	fair
3	270-460	fair	fair	fair
3	470-490	fair	fair	poor
4	50-200	good	good	good
4	210-240	good	good	fair
4	250-390	fair	fair	fair
<p>Note: The QOS levels are equivalent to the following MOS values:</p> <ul style="list-style-type: none"> • excellent 5 • good 4 • fair 3 • poor 2 				

Table 13
ITG QOS levels (Part 3 of 4)

Packet loss (%)	One-way delay (ms)	QOS level		
		G.729A	G.711A/G.711u	G.723.1
4	400-440	fair	fair	poor
5	50-180	good	good	good
5	190-210	good	good	fair
5	220-360	fair	fair	fair
5	370-400	fair	fair	poor
6	50-200	good	good	fair
6	210-330	fair	fair	fair
6	340-380	fair	fair	poor
7	50-140	good	good	fair
7	150-310	fair	fair	fair
7	320-340	fair	fair	poor
8	50-290	fair	fair	fair
8	300-320	fair	fair	poor
9	50-270	fair	fair	fair
9	280-300	fair	fair	poor
10	50-260	fair	fair	fair
<p>Note: The QOS levels are equivalent to the following MOS values:</p> <ul style="list-style-type: none"> • excellent 5 • good 4 • fair 3 • poor 2 				

Table 13
ITG QOS levels (Part 4 of 4)

Packet loss (%)	One-way delay (ms)	QOS level		
		G.729A	G.711A/G.711u	G.723.1
10	270-280	fair	fair	poor
11	50-250	fair	fair	fair
11	260-270	fair	fair	poor
12	50-230	fair	fair	fair
12	240-260	fair	fair	poor
13	50-230	fair	fair	fair
13	240-250	fair	fair	poor
14	50-210	fair	fair	fair
14	220-230	fair	fair	poor
15	50-190	fair	fair	fair
15	200-230	fair	fair	poor
16	50-160	fair	fair	fair
16	170-210	fair	fair	poor
<p>Note: The QOS levels are equivalent to the following MOS values:</p> <ul style="list-style-type: none"> • excellent 5 • good 4 • fair 3 • poor 2 				

DiffServ/TOS

The Type of Service (TOS) byte or Differentiated Service (DiffServ) code point determines the priorities of the management and voice packets in the ITG network. The range for both management and voice packet DiffServ/TOS is 0-255.

You can configure the DiffServ/TOS value, if required, to obtain better QOS over the IP data network (LAN/WAN).

The value entered depends on the policy in the customer's data network.

Note: The default value for both is 0. Do not change DiffServ/TOS from default value of 0 unless instructed by the ITG network administrator.

Loss and Level Plan

The ITG Line 2.0 card ships with a predefined loss and level plan. The loss and level plan determines various parameters, such as transmission gain, that vary from country to country. The values are stored in a file on the MAT 6.6/OTM 1.0 PC. The default loss and level plan is for the United States. You can select other countries when you configure the DSP Profile settings in the MAT 6.6/OTM 1.0 ITG IP Phones application.

Echo canceller

The echo canceller tail delay is 8, 16 or 32 ms. The default setting is 32 ms. The voice activity detection is -20 to +10 dB. The default setting is -17. The default setting is "Enable echo canceller". You can disable echo canceller when you configure the DSP Profile settings in the MAT 6.6/OTM 1.0 ITG IP Phones application.

Reducing delays

The link delay is the time it takes for a voice packet to be queued on the transmission buffer of a link until it is received at the next hop router. Link delay can be reduced by:

- upgrading link capacity. This reduces the serialization delay of the packet, but also reduces the utilization of the link and the queueing delay. Before upgrading a link the technician must check both routers connected to the link to be upgraded and make sure that router configuration guidelines are complied with.
- implementing a priority queueing discipline.

To determine which links should be considered for upgrading, first list all the intranet links used to support the ITG traffic, which can be derived from the traceroute output for each site pair. Then, using the intranet link utilization report, note the highest utilized and/or the slowest links. Estimate the link delay of suspect links using the traceroute results .

Example: a 256kbps link from router1 to router 2 has a high utilization. The following is a traceroute output that traverses this link:

```
ITG_Node1% traceroute SubnetA

traceroute to SubnetA (10.3.2.7), 30 hops max, 32
byte packets

  router1 (10.8.0.1) 1 ms 1 ms 1 ms
    router2 (10.18.0.2) 42 ms 44 ms 38 ms
      router3 (10.28.0.3) 78 ms 70 ms 81 ms
        router4 (10.3.0.1) 92 ms 90 ms 101 ms
          SubnetA (10.3.2.7) 94 ms 97 ms 95 ms
```

The average rtt time on the example link is about 40 ms; the one-way link delay is about 20 ms, of which the circuit transmission and serialization delay are just a few milliseconds. Most of this link's delay is due to queueing.

Reducing hop count

The ITG Line 2.0 card nodes must be connected to the intranet to minimize the number of router hops between Meridian 1s, assuming adequate bandwidth on the WAN links for the shorter route. This will reduce the fixed and variable IP packet delay, and improve the Voice over IP Quality of Service. It is recommended that no more than one card utilize a particular 10BaseT LAN collision domain, provided that the preferred codec throughout the ITG network is set to G.729 AB with 30 ms default payload size.

Note: In a passive Ethernet hub, all ports on the hub share one 10Mbps collision domain; in a switched Ethernet hub, each port has its own collision domain.

The ITG Line 2.0 card node and the T-LAN router should be placed as close to the WAN backbone as possible in order to:

- minimize the number of router hops.
- segregate constant bit-rate Vo IP traffic from bursty LAN traffic.
- simplify the end-to-end QOS engineering for packet delay, jitter, and packet loss.

If an access router separates the ITG Line 2.0 card node from the WAN router, there must be a high-speed link (for example, Fast Ethernet, FDDI, SONET, OC-3c, ATM STS-3c) between the access router and the WAN backbone router.

Reducing packet errors

Packet errors in intranets are generally correlated with congestion somewhere in the network. Bottleneck links tend to be where the packet errors are high because packets get dropped when they arrive faster than the link can transmit them. The task of upgrading highly utilized links should also remove the source of packet errors on a particular flow. Also an effort to reduce hop count gives fewer opportunities for routers and links to drop packets.

Other causes of packet errors, not related to queueing delay, are as follows:

- **Poor link quality.** The underlying circuit may have transmission problems, high line error rates, subject to frequent outages, etc. Note that the circuit may be provisioned on top of other services, such as X.25, frame relay, or ATM. Check with the service provider for resolution.
- **Overloaded CPU.** This is another commonly-monitored statistic collected by network management systems. If a router is overloaded, it means that the router is constantly performing processing-intensive tasks, which impedes the router from forwarding packets. Find out what the threshold CPU utilization level is, and check if any suspect router conforms to the threshold. The router may have to be re-configured or upgraded.
- **Saturation.** Routers can also be overworked when there are too many high capacity and high traffic links configured on it. Ensure that routers are dimensioned according to vendor guidelines.

- **LAN saturation.** Packets may be dropped on under-engineered or faulty LAN segments.
- **Jitter buffer too small.** Packets that arrive at the destination ITG, but too late to be placed in the jitter buffer are essentially loss packets.

Adjusting jitter buffer size

The jitter buffer parameters directly affect the end-to-end delay. Lowering the *voice playout* settings decreases *one-way delay*, but this comes at the expense of giving less waiting time for voice packets that arrive late.

You adjust the jitter buffer size when you configure the DSP Profiles in the ITG IP Phone application. The jitter buffer is statically configured and is the same for all devices in the network. The jitter buffer size range is 0-200 milliseconds. The default value is 50 milliseconds.

As each call is set up, the jitter buffer for each device is set to the next larger configurable value for the selected codec. If the jitter buffer depth is configured as zero, the depth of the jitter buffer is set to the smallest value the device can support. In practice, the optimum depth of the jitter queue is different for each call. For sets that are on a local LAN connection, a short jitter queue is desirable to minimize delay. For sets that are several router hops away, a longer jitter queue is required.

Lowering the jitter buffer size decreases the *one-way delay* of voice packets; however setting the jitter buffer size too small will cause unnecessary packet discard.

If the technician decides to discard packets, to downsize the jitter buffer, he must do the following:

- **Check the delay variation statistics.** Obtain the *one-way delay* distributions originating from all source ITG sites.
- **Compute the standard deviation of *one-way delay* for every flow.** Some traffic sources with few hop counts yield small delay variations, but it is the flows that produce great delay variations that should be used to determine whether it is acceptable to resize the jitter buffer.
- **Compute the standard deviation (σ) of one-way delay for that flow.** It is recommended that the jitter buffer size should not be set smaller than 2σ .

Post-installation network measurements

The design process is continual, even after implementation of the ITG network and commissioning of voice services over the network. Network changes – in actual ITG traffic, general intranet traffic patterns, network policies, network topology, user expectations and networking technology – can render a design obsolete or non-compliant with QOS objectives. The design needs to be reviewed periodically against prevailing network conditions and traffic patterns.

It is assumed that the customer's organization already has processes to monitor, analyze, and re-design both the Meridian 1 network and the corporate intranet to maintain internal QOS standards. When operating an ITG network, additional processes must be developed to:

- collect, analyze, and forecast ITG traffic patterns.
- monitor operational measurements (see below).
- implement changes in the ITG and intranet when planning thresholds are reached.

By instituting these new processes, the ITG network can be managed to ensure that desired QOS objectives are met.

ITG Operational Measurement

The ITG Line 2.0 Card collects operational measurements from the i2004 Internet Telephone sets and DSP channels and saves the information to a log file every 60 minutes. The operational measurements include:

- i2004 Internet Telephone Registration Attempted/Confirmed.
- i2004 Internet Telephone Unregistration Attempted/Confirmed.
- Audio Stream Set Up Attempted/Completed.
- Total Voice Time (min.).
- i2004 Internet Telephone Phone Total Packets Lost/Late.
- DSP Channel Total Packets Lost/Late.

OM Report description

The OM log file is a comma-separated (.csv) file stored on the MAT 6.6/OTM 1.0 PC. Using MAT/OTM you can run an adhoc report or schedule a regular report. A new file is created for each month of the year in which OM data is collected. It can be read directly or imported to Microsoft Excel for post-processing and report generation. Collect these OM reports and store them for analysis. At the end of each month, identify the hours with the highest packet lost/late statistics and standard deviation statistics generated. Compare the data to target network QOS objectives.

Declines in QOS can be observed through the comparison of QOS between last period and current period. A consistent inferior measurement of QOS compared with the objective should trigger an alarm to the customer that the customer must take steps to strengthen the performance of the route.

The card creates a new log file each day. Files are automatically deleted after seven days.

Select subnet configuration

A subnet is defined as a remote network serving a collection of i2004 Internet Telephones, which is represented by a Server or Router communicating with the ITG processor for VoIP service. (See Figure 11 on page 67.)

Separate subnet configuration

Each ITG card has two Ethernet ports, one for the Telephony LAN (T-LAN) and one for the Embedded LAN (E-LAN). The advantages of this configuration are:

- optimization of Vo IP performance on the Telephony LAN segment by segregating it from E-LAN traffic and connecting the T-LAN as close as possible to the WAN router.
- making the amount of traffic on the T-LAN more predictable for QOS engineering.
- optimization of E-LAN performance. For example, for Symposium Call Center Server (SCCS) and Call Pilot functional signaling, segregating the E-LAN from ITG T-LAN VoIP traffic.

- enhanced network access security by allowing the modem router to be placed on the E-LAN, which can be isolated from the customer's enterprise network (C-LAN), or have access to and from the C-LAN only through a fire-wall router.

Note 1: Nortel Networks strongly recommends that customers place the voice and management LANs on separate dedicated subnets, separated by a router.

Note 2: When using separate subnets, the Network Activity LEDs provide valuable maintenance information for the Ethernet voice interface. The single subnet configuration eliminates the use of the Ethernet voice interface with its associated Network Activity LEDs.

Single subnet configuration

Note: Nortel Networks **does not** recommend the single subnet configuration.

It is possible to route both voice T-LAN and management E-LAN through the same subnet. Generally, this will result in lowered voice QOS due to the additional management traffic.

However, the “single subnet option” can be used where:

- the combined voice and management traffic on the E-LAN is so low that there is no impact on voice QOS performance.
- the customer is willing to tolerate occasional voice quality impairments due to excessive management traffic.
- no fire-wall router exists between the E-LAN and the C-LAN.

Installation and configuration summary

Contents

This section contains information on the following topics:

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i2004 Internet Telephone configuration data summary sheet	95

Overview

This chapter provides a summary of the procedures required to install a new Meridian Internet Telephony Gateway (ITG) Line 2.0 card node, add cards to the node, install the cards, transmit data to the cards, and install the i2004 Internet Telephone. It also includes information on what you need before beginning the installation procedures.

Be sure to read the Engineering guidelines section before you install an ITG Line 2.0 node.

Before you begin

- 1 Upgrade Meridian 1 X11 software to Release 25.30 or later.
- 2 Upgrade the M1 keycodes to expand the ISM system limit to support the number of i2004 Internet Telephones you plan to install. Refer to Overlay 22 in the *M1 System Maintenance Guide* (553-3001-511).
- 3 Verify that you have the latest MAT version 6.67.07 (or later), or OTM version 1.0 (or later).
 - a Check the M1 ESD website to determine the latest software version.

Refer to Procedure 20, "Navigate through the M1 ESD website" on page 152.
 - b Upgrade to the latest version if necessary.

Refer to "ITG MAT 6.67.07 (with update disk)/OTM 1.0 management PC" on page 159 for further details.
- 4 Create site name, system name and customer number in the MAT/OTM Navigator. Specify the correct M1 system type in order for MAT to prompt for correct TN format.
- 5 Provision the IP network, ITG line card node and i2004 sets
 - a **Choose the DHCP mode:** Full, Partial or None(static). For Full DHCP mode, refer to "Configuring DHCP server to support Full DHCP mode" on page 101.
 - b **Choose the Ethernet connection:** desktop hub or switch, or a separate cable to the equipment closet.
 - c **Determine T-LAN, E-LAN IP address Ethernet connections** from the network IP administrator.
- 6 Check that the required LAN and WAN networking equipment and cables are installed. For networking requirements, refer to "IP Network engineering guidelines" on page 55.

————— *End of Procedure* —————

Installation procedure summary

Summary of steps

The following summary of steps can be used as a reference guide to install and configure an ITG Line 2.0 card node. This summary is intended to serve as a pointer to the more detailed procedures contained in other chapters and to provide a sequential flow to the steps involved in the overall installation procedure.

Note: Complete all installation and configuration steps before you transmit data to the ITG line cards.

- 1 Complete the ITG Line 2.0 card installation summary sheet. Refer to Table 14 on page 94.
- 2 Complete the i2004 Internet Telephone configuration data summary sheet. Refer to Table 15 on page 95.
- 3 Install the hardware components:
 - a **Install and cable ITG line 2.0 card(s).** Refer to Procedure 5 on page 113.
 - b **Install an ITG-specific I/O Panel Filter Connector (large Systems only).** Refer to Procedure 6 on page 115.
 - c **Install the E-LAN, T-LAN serial interface cable.** Refer to Procedure 7 on page 117.
- 4 Configure ITG line 2.0 data on the Meridian 1
 - a **Configure the IP address for the M1 Ethernet interface.** Refer to Procedure 8 on page 118.
 - b **Configure bandwidth management zones.** Refer to page 119.
 - c **Configure ITG physical TNs.** Refer to page 121.
 - d **Configure virtual superloops.** Refer to page 122.
 - e **Small system mapping of virtual superloops.** Refer to page 123.
 - f **Configure i2004 meridian 1 features.** Refer to page 124
- 5 Configure ITG line 2.0 data on MAT/OTM
 - a **Manually add an ITG card node.** Refer to Procedure 9 on page 128.

- b Configure ITG line card properties.** Refer to Procedure 10 on page 131.
 - c Configure DSP Profile data.** Refer to Procedure 11 on page 134.
 - d Configure E-LAN IP address and T-LAN Voice port.** Refer to Procedure 12 on page 135.
 - e Configure security for SNMP access.** Refer to Procedure 13 on page 137.
 - f Configure SNMP traps.** Refer to Procedure 14 on page 138.
 - g Configure alarm notification feature.** Refer to Procedure 15 on page 140.
- 6 Transmit ITG line card configuration data from MAT to the ITG cards**
 - a Set Leader 0 IP Address.** Refer to Procedure 16 on page 146.
 - b Transmit node and card properties to Leader 0.** Refer to Procedure 17 on page 148.
 - c Transmit card properties to all cards in the node.** Refer to Procedure 18 on page 150.
- 7 Upgrade card software and i2004 Internet telephone firmware**
 - a Verify card software and i2004 set firmware release.** Refer to Procedure 19 on page 151.
 - b Determine latest software and firmware versions from M1 ESD website.** Refer to Procedure 20 on page 152.
 - c Upgrade ITG Line card software (if required).** Refer to Procedure 21 on page 153.
 - d Upgrade i2004 Internet telephone firmware (if required).** Refer to Procedure 23 on page 156.
- 8 Assemble and install an i2004 Internet Telephone.** Refer to Procedure 25, "Manual first-time installation of the i2004 Internet Telephone" on page 169; and to the *Meridian 1 Internet Telephone i2004 User Guide*, version 1.0.

————— *End of Procedure* —————

ITG Line 2.0 card installation summary sheet

Nortel Networks recommends that you complete an ITG Line 2.0 card installation summary sheet (Table 14) as you unpack, inventory and provision the cards. IP information will normally be supplied by the customer's IP Network Administrator.

In order to complete the installation summary sheet you need to know:

- the MAC address. This is the MOTHERBOARD Ethernet address on the ITG Line 2.0 card faceplate sticker (for example 00:60:38:01:12:77).
- the E-LAN Management IP address of the MOTHERBOARD Ethernet interface used to perform management through MAT/OTM and to communicate with the Meridian 1 PBX.
- the T-LAN Node IP address.
- the T-LAN Voice IP address of the voice interface.
- the IP address of the active ELNK Ethernet interface on the Meridian 1 core.

Table 14
ITG Line 2.0 card installation summary sheet

Site _____ M1 system _____ M1 customer _____ Node ID _____				
T-LAN Node IP address _____ M1 active ELNK IP address _____				
SNMP Manager List IP addresses _____				
T-LAN subnet mask _____ T-LAN gateway _____				
E-LAN subnet mask _____ E-LAN gateway _____				
TN	MAC address	E-LAN Management IP address	T-LAN Voice IP address	Card role
				leader
				follower
				follower
				follower
				follower
				follower
				follower
				follower
				follower
				follower
				follower
				follower
				follower

i2004 Internet Telephone configuration data summary sheet

Table 15**i2004 Internet Telephone configuration data summary sheet**

IP configuration			Connect server IP address	Node#	VTN	DN	User Name	User Location
IP address	subnet mask	Gateway IP address						

Configuration of the DHCP server

Contents

This section contains information on the following topics:

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Format for Nortel Networks i2004 Internet Telephone DHCP Encapsulated Vendor Specific Option	104
Format for Nortel Networks i2004 Internet Telephone DHCP Site Specific Option	108

Overview

This chapter provides general guidelines to configure a host with a Dynamic Host Configuration Protocol (DHCP) server to support the i2004 Internet Telephone.

Note 1: This chapter assumes that you are familiar with RFC 2131, RFC 1533, and the Help manual for the DHCP server on your host. A convenient source for RFCs is <http://www.ietf.org/>

Note 2: For a general overview of DHCP server technology, refer to Appendix F: “DHCP Supplementary Information” on page 281.

i2004 Internet Telephone

The i2004 Internet Telephone is an IP Telephone, which functions as a terminal to the Meridian 1. It encodes voice as binary data and packetizes the data to transmit it over an IP Network to the ITG Line 2.0 card or to another i2004 Internet Telephone.

The Nortel Networks i2004 Internet Telephone can act as a DHCP client in one of two modes:

- Partial DHCP mode
- Full DHCP mode

Partial DHCP mode

When the i2004 Internet Telephone is configured to operate in partial DHCP mode, the DHCP server needs no special configuration to support i2004 Internet Telephones. What it gets from the DHCP server is the following network configuration parameters:

- IP address configuration for the i2004 Internet Telephone set
- Subnet mask for the i2004 Internet Telephone IP address
- Default gateway for the i2004 Internet Telephone LAN segment

Full DHCP mode

In full DHCP mode, the DHCP server requires special configuration. The i2004 Internet Telephone obtains network configuration parameters and also connect server configuration parameters from specially configured DHCP server.

The following configuration parameters are provided for the primary and secondary connect servers:

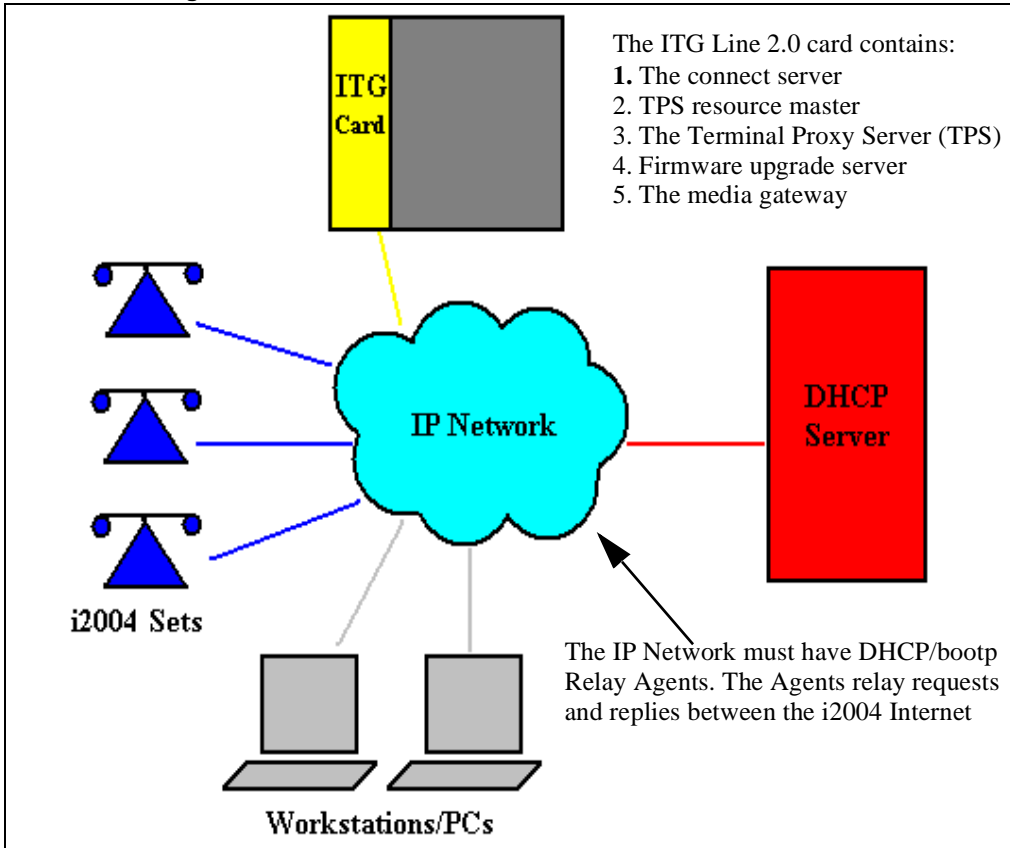
- Connect server IP address. For ITG Line 2.0, the connect server IP address is the ITG line node 2.0 IP address.
- A port number of 4100.
- A command value of one, that identifies the request to the connect server as originating from an i2004 Internet Telephone.
- A retry count typically equal to 10.

All the configuration parameters for the i2004 Internet telephones can be entered manually. However, this method is tedious since each i2004 Internet Telephone requires the network configuration parameters, connect server parameters, as well as ITG 2.0 node ID and Virtual TN. If there are many i2004 Internet Telephones to configure, manual configuration is time consuming and error prone. Using Full or Partial DHCP to configure the i2004 Internet Telephones automatically is more efficient and flexible; ensuring that current up-to-date information is used.

Note 1: The ITG Line 2.0 node ID and virtual TN must always be configured manually even in Full DHCP mode.

Note 2: In Partial DHCP mode the connect server parameters must be entered manually as well as the node ID and VTN.

Figure 12
DHCP block diagram



ITG Line 2.0 card

An ITG Line 2.0 card is an interface between the i2004 Internet Telephone and the Meridian 1 PBX. It provides interfaces to:

- the terminal proxy server
- the media gateway channel

During start-up, the i2004 Internet Telephone registers itself with the terminal proxy server on the ITG Line 2.0 card and also the Virtual TN with configuration parameters on the M1. The media gateway channel provides an interface between the packet switched IP network and the circuit switched network of the M1.

Configuring DHCP server to support Full DHCP mode

The DHCP capability feature of the i2004 Internet Telephone, enables the set to get network configuration parameters and specific connect server parameters. This section describes the i2004 Internet Telephone's unique class identifier and requested network configuration and connect server parameters for automatic configuration.

i2004 Internet Telephone class identifier

The i2004 Internet Telephone is designed with a unique class identifier that the DHCP server can use to identify the i2004 Internet Telephone. All i2004 Internet Telephones use the same text string, "Nortel-i2004-A", to identify itself. The ASCII string is sent inside the Class Identifier option of the i2004 Internet Telephone's DHCP messages.

The DHCP server also includes this string in its responses to the i2004 Internet Telephone DHCP client. This makes it possible to notify the i2004 Internet Telephone that the server is i2004 Internet Telephone-aware, and that it is safe to accept the server's offer. This string appears in the beginning of the list of the specific ITG Line 2.0 card information that the i2004 Internet Telephone DHCP client requests.

When the DHCP server has been configured to recognize the i2004 Internet telephone as a special class, the DHCP server can treat the i2004 Internet Telephone differently than other DHCP clients. DHCP host configuration parameters can then be grouped by class and only information relevant to the i2004 DHCP client is supplied.

Also, the administrator can design the network according to the client's class, if necessary, making maintenance easier. Depending on the capabilities and limitations of the DHCP server used and the design of the network, some of these advanced functions may not be available.

Requested Network Configuration Parameters

Nortel's i2004 Internet Telephone has the ability to be configured automatically by an i2004 Internet Telephone-aware DHCP server by requesting a list of network configuration parameters. The i2004 Internet Telephone uses DHCP, an industry standard protocol, to request and receive the information.

i2004 Internet telephones operating in Partial DHCP mode can receive an IP address from *any* DHCP server. In Full DHCP mode, the server must be configured to respond to the request for the vendor specific encapsulated options.

Table 16 lists the network configuration parameters requested by the i2004 Internet Telephone in the Parameter Request List option (Option Code 55) in the DHCPDISCOVER and DHCPREQUEST messages. The DHCPOFFER and the DHCPACK reply messages from the DHCP server must contain the options in Table 16.

Table 16
i2004 Internet Telephone Network Configuration Requirements

Parameter Request (Option Code 55)	DHCP Option Code
Subnet mask - the client IP subnet mask.	1
Router/Gateway(s) - the IP address of the client's default Gateway.	3
Lease Time - implementation varies according to DHCP server.	51
Renewal time - implementation varies according to DHCP server.	58
Rebinding interval - implementation varies according to DHCP server.	59
ITG Line 2.0 Site Specific or Vendor Specific encapsulated/site options	43, 128, 144, 157, 191, 251

The first five parameters in Table 16 are standard DHCP options and have predefined option codes. The last parameter is for ITG Line 2.0 card information, which does not have a standard DHCP option. The server administrator must define a vendor encapsulated and/or site specific option to transport this information to the i2004 Internet Telephone.

This non-standard information includes the unique string identifying the i2004 Internet telephone and the connect server parameters for the primary and secondary servers. The i2004 Internet Telephone must receive the connect server parameters in order to connect to the ITG 2.0 node.

The administrator must use one of the five site specific or vendor encapsulated option codes to implement the ITG Line 2.0 card information. Then, this user-defined option can be sent as is, or encapsulated in a Vendor Encapsulated option with option code 43. Which method to use depends on the DHCP server's capabilities and what options are already in use by other vendors.

The i2004 Internet Telephone rejects any DHCP Offers/Acks that does not contain:

- A Router option. The i2004 requires a default gateway (router)
- A Subnet Mask option
- Either
 - a Vendor Specific option < see Note 1: >
 - a Site Specific option < see Note 2: >

Note 1: The Vendor Specific option is 43. Windows NT DHCP Server (up to SR4) supports only 16 octets of data for the vendor-specific option, which is insufficient to support the minimum length of the i2004-specific string. If you use a Windows NT DHCP Server, you must select the Site Specific option to accommodate the i2004-specific string.

Note 2: The Site Specific options are all DHCP options between 128 (0x80) and 254 (0xFE). These options are reserved for Site Specific use by the DHCP RFCs.

Format for Nortel Networks i2004 Internet Telephone DHCP Class Identifier Option

All i2004 Internet Telephones fill in the Class ID option of the DHCP Discovery and Request messages with the null-terminated, ASCII-encoded string Nortel-i2004-A, where A identifies the version number of the i2004 Internet Telephone.

The Class Identifier Nortel-i2004-A must be unique in the DHCP server domain.

Format for Nortel Networks i2004 Internet Telephone DHCP Encapsulated Vendor Specific Option

The following definition describes the Nortel i2004 specific, Encapsulated Vendor Specific option. This option must be encapsulated in a DHCP Vendor Specific Option (Refer to RFC 1533) and returned by the DHCP server as part of each DHCPOFFER and DHCPACK message for the i2004 to accept these messages as valid. The i2004 will extract the relevant information out of this option and use it to configure the connect server IP address, the port number (4100), a command value of one, and retry count for the primary and secondary connect server.

Note that either this encapsulated vendor specific option or a similarly encoded site-specific option must be sent (see below), that is, configure the DHCP server to send one or the other - not both. The choice of using either Vendor Specific or Site Specific option is provided to allow WinNT DHCP servers to be used with the i2004 Internet Telephone (WinNT servers do not properly implement the Vendor Specific Option, and as a result, WinNT implementations must use the Site Specific version).

The format of the Encapsulated Vendor Specific option is Type, Length, and Data as shown below.

Type (1 octet):

There are five choices:

0x80 (Site Specific option 128)

0x90 (Site Specific option 144)

0x9d (Site Specific option 157)

0xbf (Site Specific option 191)

0xfb (Site Specific option 251)

Providing a choice of five types allows the i2004 to work in environments where the initial choice may already be in use by a different vendor. Pick only one value for TYPE byte.

Length (1 octet)

The Length value is variable. Count only the number of octets in the data field (see below).

Data field (variable number of octets)

The data field contains an ASCII-encoded character string that can be optionally null-terminated.

"Nortel-i2004-A,iii.jjj.kkk.lll:ppppp,aaa,rrr;iii.jjj.kkk.lll:pppp,aaa,rrr."

where,

"Nortel-i2004-A" - uniquely identifies that this is the Nortel option and is a response from a server that can provide the correct configuration information to the i2004 Internet Telephone.

Additionally, the "-A" signifies the version of the i2004 Internet Telephone.

ASCII ",", separates fields

ASCII ":" separates the IP address of the bootstrap server node IP from the Transport Layer port number

ASCII ";" separates the Primary from Secondary bootstrap server information. The bootstrap server is the Active Leader of the ITG Line 2.0 node.

ASCII "." signals end of structure

"iii.jjj.kkk.lll:ppppp" - identifies IP address and port number for server (ASCII encoded decimal)

"aaa" - identifies Action for server (ASCII encoded decimal, range 0..255)

"rrr" - identifies retry count for server (ASCII encoded decimal, range 0..255)

This string may be NULL terminated although the NULL is not required for parsing.

Notes:

- 1 "aaa" and "rrr" are ASCII encoded decimal numbers with a range of 0..255. They identify the "Action Code" and "Retry Count", respectively, for the associated TPS server. Internally to i2004 they will be stored as 1 octet (0x00..0xFF). Note that these fields must be no more than 3 digits long.
- 2 First server is always considered "Primary", second server always considered "Secondary".
- 3 If only one server is required, terminate primary TPS sequence immediately with "." instead of ";" for example, "Nortel-i2004-A,iii.jjj.kkk.lll:ppppp,aaa,rrr."

- 4 Valid options are one or two servers (0 or 3 is not allowed). However, it is recommended that the two server option be used. For i2004 Internet Telephone firmware version 3002B00, the valid option is two servers.

Note: If there is only one connect server (i.e. only one ITG 2.0 node is configured), enter the same information for server 1 and server 2.

- 5 Action code values:

0- reserved

1- UNISlim Hello (currently only this type is a valid choice)

2..254 - reserved

255 - reserved

- 6 iii,jjj,kkk,lll are ASCII encoded, decimal numbers representing the IP address of the server. They do not need to be three digits long as the . and : delimiters will guarantee parsing. For example, '001', '01' and '1' would all be parsed correctly and interpreted as value 0x01 internal to the i2004. Note that these fields must be no more than 3 digits long each.
- 7 ppppp is the port number in ASCII encoded decimal. It does not need to be 5 digits long as the : and , delimiters will guarantee parsing. For example, '05001', '5001', '1', '00001' etc. would all be parsed correctly and accepted as correct. The valid range is 0-65535 (stored internally in i2004 as hexadecimal in range 0..0xFFFF). Note that this field must be no more than 5 digits long.
- 8 In all cases, the ASCII encoded numbers are treated as decimal values and all leading zeros are ignored. More specifically, a leading zero does not change the interpretation of the value to be OCTAL encoded. For example, 0021, 021 and 21 are all parsed and interpreted as decimal 21.

Format for Nortel Networks i2004 Internet Telephone DHCP Site Specific Option

The following definition describes the Nortel i2004 specific, Site Specific option. This option uses the "reserved for site specific use" DHCP options (128 to 254 - Refer to RFC 1541 and RFC 1533) and must be returned by the DHCP server as part of each DHCP OFFER and ACK message for the i2004 to accept these messages as valid. The i2004 will pull the relevant information out of this option and use it to configure the IP address etc. for the primary and (optionally) secondary TPS's. Note that either this site specific option must be present OR a similarly encoded vendor-specific option must be sent (as described above), that is, configure the DHCP server to send one or the other - not both. The choice of using either Vendor Specific or Site Specific options was provided to allow WinNT DHCP servers to be used with the i2004 (WinNT servers do not properly implement the Vendor Specific Option and as a result, WinNT implementations must use the Site Specific version).

Format of field is: Type, Length, Data.

Type (1 octet):

5 choices 0x80, 0x90, 0x9d, 0xbf, 0xfb (128, 144, 157, 191, 251).

Providing a choice of five types allows the i2004 to work in environments where the initial choice may already be in use by a different vendor. Pick only one TYPE byte.

Length (1 octet):

variable - depends on message content.

Data (length octets):

- ASCII based

- format

"Nortel-i2004-A,iii.jjj.kkk.lll:ppppp,aaa,rrr;iii.jjj.kkk.lll:pppp,aaa,rrr."

where,

"Nortel-i2004-A" - uniquely identifies this as the Nortel option

Additionally, the "-A" signifies the version. Future enhancements could use "-B" for example.

ASCII "," is used to separate fields

ASCII ";" is used to separate Primary from Secondary server info

ASCII "." is used to signal end of structure

"iii.jjj.kkk.lll:ppppp" - identifies IP:port for server (ASCII encoded decimal)

"aaa" - identifies Action for server (ASCII encoded decimal, range 0-255)

"rrr" - identifies retry count for server (ASCII encoded decimal, range 0-255)

This string may be NULL terminated although the NULL is not required for parsing.

Notes:

- 1 "aaa" and "rrr" are ASCII encoded decimal numbers with a range of 0-255. They identify the "Action Code" and "Retry Count", respectively, for the associated TPS server. Internally to i2004 they will be stored as 1 octet (0x00..0xFF). Note that these fields must be no more than 3 digits long.
- 2 First server is always considered "Primary", second server always considered "Secondary".
- 3 If only one server is required, terminate primary TPS sequence immediately with "." instead of ";" for example "Nortel-i2004-A,iii.jjj.kkk.lll:ppppp,aaa,rrr."
- 4 Valid options are one or two servers (0 or 3 is not allowed). However, it is recommended that the two server option be used. For i2004 Internet Telephone firmware version 3002B00, the valid option is two servers.

Note: If there is only one connect server (i.e. only one ITG 2.0 node is configured), enter the same information for server 1 and server 2.

- 5 Action code values:
- 0 - reserved
 - 1 - UNISlim Hello (currently only this type is a valid choice)
 - 2-254 - reserved
 - 255 - reserved
- 6 iii,jjj,kkk,lll are ASCII encoded, decimal numbers representing the IP address of the server. They do not need to be 3 digits long as the . and : delimiters will guarantee parsing. For example, '001', '01' and '1' would all be parsed correctly and interpreted as value 0x01 internal to the i2004. Note that these fields must be no more than 3 digits long each.
- 7 ppppp is the port number in ASCII encoded decimal. It does not need to be 5 digits long as the : and , delimiters will guarantee parsing. For example, '05001', '5001', '1', '00001' etc. would all be parsed correctly and accepted as correct. The valid range is 0-65535 (stored internally in i2004 as hexadecimal in range 0..0xFFFF). Note that this field must be no more than 5 digits long.
- 8 In all cases, the ASCII encoded numbers are treated as decimal values and all leading zeros are ignored. More specifically, a leading zero does not change the interpretation of the value to be OCTAL encoded. For example, 0021, 021 and 21 are all parsed and interpreted as decimal 21.

————— *End of Notes* —————

Installation and configuration of ITG Line 2.0 node

Contents

This section contains information on the following topics:

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Overview

This chapter explains how to install and configure new ITG Line 2.0 nodes, cards and associated cables; configure and transmit ITG Line 2.0 data on Meridian 1 and MAT; upgrade ITG Line 2.0 card software; upgrade i2004 Internet telephone firmware.

The following is a list of procedures contained in this chapter:

- Procedure 5, “ITG Line 2.0 card installation” on page 113
- Procedure 6, “Remove existing I/O panel Filter Connector” on page 115
- Procedure 7, “Installing the NTMF94EA E-LAN, T-LAN, serial interface cable” on page 117
- Procedure 8, “Configure the IP address for the Ethernet interface” on page 118
- Procedure 9, “Add an ITG line 2.0 node manually” on page 128
- Procedure 10, “Configure ITG Line 2.0 card properties” on page 131
- Procedure , “Configure DSP profile data” on page 133
- Procedure 12, “Configure E-LAN M1 IP address and T-LAN voice port” on page 135
- Procedure 13, “Configuring security for MAT SNMP access” on page 137
- Procedure 14, “Configuring SNMP traps” on page 138
- Procedure 15, “Configuring MAT/OTM alarm notification feature” on page 140
- Procedure 16, “Set the Leader 0 IP address” on page 146
- Procedure 17, “Transmit node and card properties to Leader 0” on page 148
- Procedure 18, “Transmit card properties to all cards in the node” on page 150
- Procedure 19, “Verify card software and i2004 Internet Telephone firmware” on page 151
- Procedure 20, “Navigate through the M1 ESD website” on page 152

- Procedure 21, “Upgrade ITG Line card software from the web” on page 153
- Procedure 22, “Upgrade ITG card software by PC card” on page 155
- Procedure 23, “Upgrade i2004 Internet Telephone firmware” on page 156

Be sure to read the Engineering guidelines section before you install an ITG Line 2.0 node.

Install the hardware components

Install and cable ITG Line 2.0 card

Each ITG Line 2.0 card requires two slots in the Meridian 1 IPE shelf. Only the left slot of the card connects to the Meridian 1 IPE Backplane and I/O panel.

You can install a maximum of eight ITG cards in an IPE shelf. The ITG card can occupy any two adjacent slots in an IPE shelf, with the left slot of the card plugging into slots 0 to 6 and 8 to 15. You cannot plug in the left slot of an ITG card in slot 7, because the XPEC card is situated in-between slots 7 and 8.

To allow a module to hold the maximum number of ITG cards, install each card with the left slot of the card inserted into an even-numbered slot.

CAUTION

Wear an electrostatic discharge strap when handling ITG cards. As an additional safety measure, handle all cards by the edges and, when possible, with the loosened packaging material still around the component.

Procedure 5 **ITG Line 2.0 card installation**

- 1 For each ITG line card in the node, identify the IPE card slot selected for the ITG Line card. Use the information from the “ITG Line 2.0 card installation summary sheet” on page 94, and Table 17 on page 114.

Note: Even though the ITG Line 2.0 card is a two-slot card, only the left slot is counted for the card slot number. Example: the slot number is 2 for an ITG Line 2.0 card installed in slots 2 and 3.

- Remove any existing I/O panel cabling associated with any card previously installed in the selected card slot.
- Pull the top and bottom locking devices away from the ITG Line 2.0 Leader 0 card faceplate.
- Insert the ITG Line 2.0 card into the card guides and gently push it until it makes contact with the Backplane connector. Hook the locking devices.

Note 1: The red LED on the faceplate remains lit until the card is configured and enabled in software, at which point it turns off.

Note 2: The faceplate display window displays startup selftest results (T:xx) and status messages. A display “F:xx” indicates a failure of the self-test. It is normal for the card to display “F:10” during the start-up self test. F:10 indicates that the self-test did not find a Security Device. The ITG Line 2.0 card does not have a security device. Some failures indicate that the card must be replaced.

Refer to “Faceplate maintenance display codes” on page 206 for a listing of display codes.

End of Procedure

Table 17
ITG installation by module type

Meridian 1 Modules	ITG Card Slots
NT8D37BA/EC IPE modules, NT8D11BC/ED CE/PE modules	All available IPE card slots.
NT8D37AA/DC IPE modules	0, 4, 8, and 12
NT8D11AC/DC CE/PE modules	0

Install NTCW84JA Large System ITG-specific I/O Panel Filter Connector

Note: This NTCW84JA ITG-specific Filter Connector is not required on Option 11C and 11C Mini systems.

CAUTION

For large systems manufactured during the period of 1998-1999 and shipped in North America, the IPE modules have the NT8D81BA Backplane to I/O Panel ribbon cable assembly with a non-removable Filter Connector. The NT8D81BA is compatible with 10BaseT T-LAN, but if you require a 100BaseT T-LAN, you need to order the NT8D81AA Backplane to I/O Panel ribbon cable assembly to replace it. Do not try to install the NTCW84JA ITG-specific Filter Connector onto the existing non-removable Filter Connector.

Remove existing I/O panel Filter Connector

The standard I/O Filter Connector is shielded metal with a black plastic insert connector. The NTCW84JA connector uses yellow warning labels to indicate EMC filtering modifications and which MDF connection points can support 100BaseT connections.

Procedure 6

Remove existing I/O panel Filter Connector

- 1 Before any of the following steps, remove the ITG pack, or any other IPE pack, from the IPE shelf card slot corresponding to the I/O Panel connector to be removed.

Note: Make sure to use the I/O panel connector which corresponds to the left slot number of the DCHIP card.

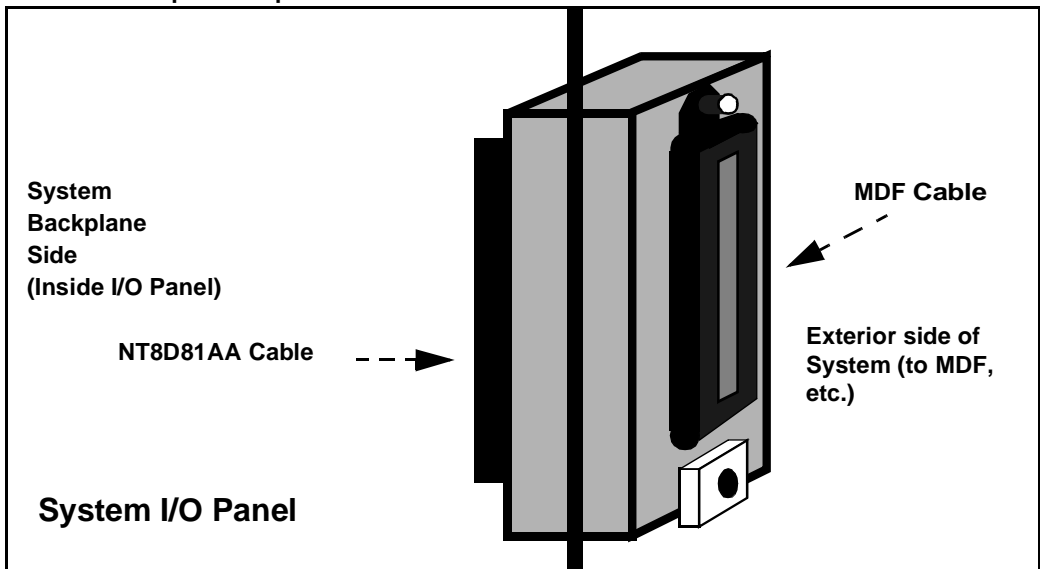
- 2 Remove the NT8D81AA Backplane to I/O Panel ribbon cable assembly, which is connected to the Backplane side of the existing block, by releasing the latching pins on the filter block and pulling the NT8D81AA cable away.
- 3 Unscrew the existing Filter Connector from the I/O panel. There is one screw on the lower front of the connector and one screw on the upper back of the connector. Remove the connector.

- 4 Re-position the new NTCW84JA Filter Connector in the now vacant I/O panel opening. (See Figure 13 on page 116.)
- 5 Attach the new NTCW84JA ITG-specific Filter Connector to the I/O panel by securely fastening the top back screw and the bottom front screw.
- 6 Reconnect the NT8D81AA cable and secure it in place by snapping shut the locking latches provided on the NTCW84JA connector.

----- *End of Procedure* -----

Figure 13

NTCW84JA 50 pin ITG-specific I/O Panel Filter Connector



Install the NTMF94EA E-LAN, T-LAN, serial interface cable

The NTMF94EA cable provides the E-LAN, T-LAN and serial interface for the NT8R17 IP Line card. Refer to “NTMF94EA I/O cable” on page 235 for pinouts and technical specifications on the NTMF94EA cable.

Procedure 7**Installing the NTMF94EA E-LAN, T-LAN, serial interface cable****IMPORTANT**

You must plug all IP Line card T-LAN interfaces belonging to the same ITG node into the same T-LAN hub.

Plug all IP Line card E-LAN interfaces belonging to the same ITG node into the same E-LAN hub.

- 1 On large systems, connect the NTMF94EA E-LAN, T-LAN, and RS232 Serial Maintenance I/O cable to the I/O panel connector for the left hand card slot.

If you have an Option 11C or 11 C Mini, connect the cable to the I/O connector in the cabinet that corresponds to the IP Line card slot (see Figure 35 on page 237).

- 2 Connect a shielded Category 5 cable from the customer's LAN/WAN equipment to the port labeled "T-LAN".
- 3 Connect a shielded Category 5 cable from the customer's LAN/WAN equipment to the port labeled "E-LAN".
- 4 Install the NTAG81CA serial cable into the faceplate Maint port or in the serial port of the NTMF94EA interface cable. If required, use the NTAG81BA maintenance extender cable.

WARNING

The serial maintenance ports presented at the faceplate and at the backplane are identical. Do not connect a terminal to both access points simultaneously. This will result in incorrect and unpredictable operation of the ITG card.

Note 1: The hub LEDs and the faceplate link LEDs light when you connect the card to the WAN/LAN through the E-LAN and T-LAN ports.

Note 2: Refer to “IP Network engineering guidelines” on page 55 for more details about engineering and connecting the LAN/WAN.

————— *End of Procedure* —————

Configure ITG Line 2.0 data on the Meridian 1

Before you proceed:

- Verify the Meridian 1 software release running on your system. The minimum required software release to support ITG Line 2.0 is R25.30.
- Verify the ISM System Limit in Overlay 32. The ISM system limit must have sufficient unused units to support the number of i2004 sets you are installing. Refer to the *M1 System Maintenance Guide* (NTP 553-3001-511).
- Expand the ISM System Limit, if required, by ordering additional ISM Parameters (NTZC82AA). Refer to Table 2, “Meridian ITG Line 2.0 package components,” on page 17 and “Ordering rules for ITG Line 2.0” on page 19.

Configure IP address for the M1 Ethernet Interface (LD 117)

Procedure 8

Configure the IP address for the Ethernet interface

- 1 Go into Overlay 117.
- 2 Create host entries by entering one of the following commands:

 NEW HOST PRIMARY_IP xx.xx.xx.xx

 NEW HOST SECONDARY_IP xx.xx.xx.xx (for Dual CPU only)

 NEW HOST GATEWAY_IP xx.xx.xx.xx (if connected to customer LAN)
- 3 Assign host to primary and/or secondary IP address(es) by entering one of the following commands:

 CHG ELNK ACTIVE PRIMARY_IP

 CHG ELNK INACTIVE SECONDARY_IP (for Dual CPU only)

- 4 Verify your IP address for the Ethernet by entering the following command: **PRT ELNK**.
- 5 Update DBS.
- 6 Go to Overlay 137. Check the status of the Ethernet interface by entering the command: **STAT ENLK**. If the ELNK is disabled, enable it by entering: **ENL ELNK**.

————— *End of Procedure* —————

Configure bandwidth management zones (LD 117)

In Overlay 117 you can define up to 256 zones. The Audio Connection Proxy uses the zones for bandwidth management.

In the following procedure, the term Intrazone means within the same zone, and Interzone means between two different zones.

Table 18 on page 120, list the four zone parameters as:

- p1 - Total bandwidth (kbps) available for Intrazone calls
- p2 - Defines the codec for Intrazone calls (i.e. preserve voice quality or preserve bandwidth). BQ provides Best Quality but uses the most bandwidth, whereas BB uses the least amount of Bandwidth but reduces voice quality.

- p3 - The total bandwidth available for Interzone calls
- p4 - The preferred strategy for the choice of the codec for Interzone calls

Overlay 117 also includes DIS and ENL commands to disable or enable a zone. When you create a zone, its default state is enabled.

Note: When defining zones in Overlay 117, you must begin with Zone 0.

Table 18
LD 117 bandwidth management zones configuration

=> Command	Description
NEW ZONE xxx p1 p2 p3 p4	<p>User creates a new zone, where: xxx = zone number = (0) - 255</p> <p>p1 = Intrazone available bandwidth (kbps) = 0 - (10000) - 100000</p> <p>p2 = Intrazone preferred strategy = BQ for Best Quality or BB for Best Bandwidth</p> <p>p3 = Interzone available bandwidth (kbps) = 0 - (10000) - 100000</p> <p>p4 = Interzone preferred strategy = BQ or BB</p>
New ZONE xxx	<p>User creates a new zone with default values for the parameters: p1 = 10000 (kbps) p2 = BQ p3 = 10000 (kbps) p4 = BQ</p>
CHG ZONE xxx p1 p2 p3 p4	User changes parameters of a zone. All parameters must be re-entered, even those that are unchanged.
OUT ZONE xxx	User removes a zone.
DIS ZONE xxx	Allows user to disable a zone. When you disable zone, no new calls are established inside, from or toward this zone.

Table 18
LD 117 bandwidth management zones configuration

=> Command	Description
ENL ZONE xxx	Allows user to enable a zone.
PRT ZONE xxx	Prints zone and bandwidth information.

Configure ITG physical TNs (LD 14)

Use LD 14 to define ITG card physical TNs. LD 14 includes a new prompt **IPTN** (ITG Physical TN) to differentiate the ITG voice media gateway channels from the IP trunk units of an ITG trunk 2.0 card.

Table 19
Configure ITG physical TNs in LD 14

Prompt	Response	Description
REQ	New 24	Create 24 ITG voice media gateway channels on an ITG Line 2.0 card.
TYPE	TIE	TIE Trunk. There is no route datablock required for IPTNs.
TN	l s c u c u	TN of the first ITG Physical TN (large system) (Option 11C TN format.)
DES	aa.....a	ITG Physical TN.
XTRK	itg2	ITG2 is the NTVQ55AA ITG line card which occupies 2 card slots.
MAXU	24	Maximum number of voice media gateway channels on the ITG Line 2.0 card.
IPTN	YES	ITG Physical TN.
ZONE	0 - 255	Zone number to which this ITG Physical TN belongs. You must verify that the zone exists in Overlay 117.
CUST	0 - 99	The customer to which the IPTN resources are assigned Note: This means that for multi-customer M1 systems, each customer must have a dedicated ITG line node for i2004 Internet Telephones.

Configure virtual superloops for i2004 Internet Telephones (LD 97)

You must configure one or more virtual superloops to support i2004 Internet Telephones Virtual TNs (VTNs). Virtual superloops are distinct from phantom superloops and standard superloops and compete for network groups in physically and non-physically equipped network groups.

In large systems, virtual superloops can reside in physically equipped network groups, or in virtual network groups from Group 0 - 4 for IGS based systems, or Group 0 - 7 for Fiber Network Fabric (FNF) based systems.

Without Package 365, there is a maximum of five network groups available. With Package 365, there are is a maximum of eight network groups for a total of 1024 VTNs configurable on a single virtual superloop for a large system.

It is recommended that you start configuring Virtual Superloops in the highest non-physically equipped group available. Table 20 lists the prompts and responses required to configure virtual superloops in Overlay 97.

Table 20
 Virtual superloop configuration in LD 97

Prompt	Response	Description
REQ	CHG	Change.
TYPE	SUPL	Superloop
SUPL	Vxxx	V stands for a virtual superloop and xxx is the number of the virtual superloop. xxx = 0-156 and multiple of four for large systems without FNF package 365. xxx = 0-252 and multiple of four for large systems with FNF package 365. xxx = 96-112 and multiple of four for Option 11C and 11C Mini.

Small system mapping of virtual superloops

Up to 128 VTNs can be configured on a single virtual superloop for a small system, for a maximum number of 640 VTNs in each system.

Mapping virtual superloops on a small system is the same as mapping phantom loops. Refer to Table 21.

Table 21
Virtual superloop mapping for small systems

SUPL	Card
96	61-64
100	65-68
104	69-72
108	73-76
112	77-80

Configure i2004 Meridian 1 features (LD11)

The existing ISM header that is printed at the start of Overlay 11 includes the new ISM limit for the i2004 Internet Telephone. Refer to Table 22 to configure the i2004 Internet Telephone in Overlay 11.

Table 22
LD 11 Configure i2004 Internet Telephone (Part 1 of 2)

Prompt	Response	Description
REQ:	NEW CHG PRT OUT CPY MOV	Action request. New Change Print Out Copy Move
TYPE:	I2004	For model i2004 Internet Telephone. Meridian 1 accepts this response if it is equipped with packages 88 and 170.
TN	l s c u c u	Enter loop (virtual loop), shelf, card and unit (terminal number) Slot (virtual slot) and unit for Option 11C. Unit number is 1-31.
des	a...z	ODAS telephone designator
CUST	0-99	Customer number.
...
ZONE	0-255	Zone number to which this i2004 Internet Telephone belongs. The zone prompt only applied when TYPE=i2004 Note: You must verify that the zone number exists in LD 117.

Table 22
LD 11 Configure i2004 Internet Telephone (Part 2 of 2)

Prompt	Response	Description
...
CLS	aaaa	<p>ADD - Automatic Digit Display, default for i2004 Internet Telephone (HFD), HFA - Handsfree Denied, Allowed</p> <p>All default classes of service are:</p> <p>CLS CTD FBD WTA LPR MTD FND HTD ADD HFD GRDL MWD RMMD SMWD AAD IMD XHD IRD NID OLD POD DSX VMD CCMSD CCSD SWD LND CNDD CFTD SFD MRD DDV CNID CDCA MSID DAPA BFED RCBD ICDD CDMD LLCN MCTD CLBU AUTU GPUD DPUD DNDD CXFD ARHD FITD CLTD ASCD CPFA CPTA ABDD CFHD FICD NAID AHD DDGA NAMA USMD USRD ULAD CCBD RTDD RBDD RBHD PGND OCBD FLXD FTTC DNDY DNO3</p>
KEY	xx aaa yy zz...zz	<p>Telephone function key assignments where:</p> <p>xx = Keys 0 - 5. These are self-labeled physical keys that can be programmed with any feature.</p> <p>aaa = Key name or function</p> <p>yyy, zzz = additional information required for the key.</p> <p>Note: Keys 16 - 26 are reserved for dedicated i2004 soft keys.</p> <p>aaa can be:</p> <p>AAG AAK ACD ACNT ADL AGT AMG ACD AO3* AO6* ARC ASP AWC BFS CA CAS CFW* CH D CH L CHG* COS, CPN* CS, CWT LNK MCK MCN MCR MIK MMM MRK MSB MWK* NHC NRD NSVC NUL OBV OVB OVR PRK* PRS* PVN, PVR RAG RDL RGA* RMK RNP* SCN SIG SCU* SSU* SCC* SSC* THF TRC TRN* USR UST VCC WUK</p> <p>*Reserved for a dedicated i2004 Internet Telephone key. See Table 23.</p>

i2004 Internet Telephone dedicated soft keys

Table 23 describes the Meridian 1 features that can be assigned to dedicated soft Keys 16-26 on the i2004 Internet Telephone. Features that are not used can be removed from the dedicated soft keys. Some features will depend on the given Class of Service.

Note: If you attempt to configure anything other than the permitted response, Meridian 1 generates an error code. For related error messages, see “SCH messages” on page 278.

Table 23
LD 11 i2004 Internet Telephone dedicated soft key assignment (Part 1 of 2)

i2004 Internet Telephone key number	Response(s) Allowed
Key 16	MWK, NUL MWK - Message Waiting key
Key 17	TRN, NUL TRN - Call Transfer key.
Key 18	A03 or A06, NUL AO3 - 3-party conference key. AO6 - 6-party conference key.
Key 19	CFW, NUL CFW - Call Forward key.
Key 20	RGA, NUL RGA - Ring Again key.
Key 21	PRK, NUL PRK - Call Park key.
Key 22	RNP, NUL RNP - Ringing Number pickup key
Key 23	SCU-Speed Call User SSU-System Speed Call User SCC - Speed Call Controller SSC - System Speed Call Controller NUL

Table 23**LD 11 i2004 Internet Telephone dedicated soft key assignment (Part 2 of 2)**

i2004 Internet Telephone key number	Response(s) Allowed
Key 24	PRS, NUL PRS - Privacy Release key.
Key 25	CHG, NUL CHG - Charge Account key.
Key 26	CPN, NUL CPN - Calling Party Number key.

Configure ITG Line 2.0 data on MAT/OTM

This section uses the MAT 6.67.07(with update disk)/OTM 1.0 (or later) ITG IP Phones Application to manually add and configure an ITG card node. Multiple ITG line 2.0 card nodes for i2004 Internet Telephones are configured and managed from the same MAT PC.

All IP addresses and subnet mask data must be in dotted decimal format. Convert subnet mask data from Classless Inter-Domain (CIDR) format.

Refer to the “ITG Line 2.0 card installation summary sheet” on page 94 for IP addresses and information required in this procedure.

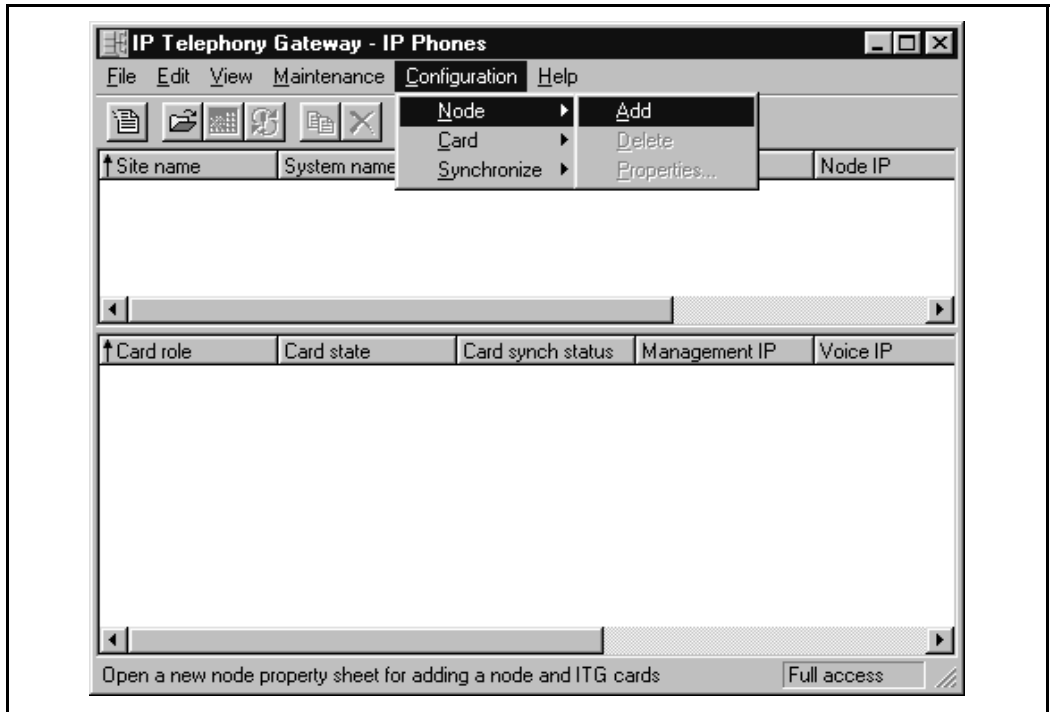
Manually add an ITG card node

Procedure 9

Add an ITG line 2.0 node manually

- 1 Launch MAT/OTM.
 - a. Double-click **Services**.
 - b. Double-click **ITG IP Phones**. The **ITG IP Phones** window opens (see Figure 14 on page 129).
- 2 Click **Configuration | Node | Add**. The **Add Node** dialog box appears.
- 3 Click **OK** to accept the default setting "Define node configuration manually". The **New ITG Node** General tab appears (see Figure 15 on page 131).
- 4 Enter **Node Location** data from the **New ITG Node General** tab:
 - a. Select a MAT/OTM site, MAT/OTM system and customer number.
 - b. Type in a node number (one to three digits). Do **not** enter four digits. The four digit Node Number field in the tab corresponds to the three digit Node ID field in the i2004 Internet Telephone configuration.
 - c. Write down the node number, which is used in the i2004 Internet Telephone configuration.

Figure 14
IP Telephony Gateway - IP Phones main window



- 5** Enter **Network Connections** data.
- For ITG line 2.0, you must check the option, "Use separate subnets for voice and management".

CAUTION

Using the single subnet option will cause unacceptable performance for ITG Line 2.0.

- Enter Voice LAN Node IP address (in dotted decimal format). Press the space bar to move between each decimal point.
- Enter Management LAN Gateway IP address (in dotted decimal format). If there is no management LAN gateway, enter: **0.0.0.0**

- d. Enter Management LAN subnet mask address (in dotted decimal format).
 - e. Enter Voice LAN subnet mask address (in dotted decimal format).
- 6 Click the **Configuration** tab.

CAUTION

Do not click OK at this point. If you click OK you will exit the General Tab Node properties configuration without saving any of the changes.

————— *End of Procedure* —————

Figure 15
New ITG Node General tab

New ITG Node

General | Configuration | DSP Profile | SNMP Traps/Routing and IPs | Ports | Security

Node Location

MAT site: [dropdown]
MAT system: [dropdown]
Customer: [dropdown]
Node number: [text]
Type: Meridian 1 - Unknown

Network Connections

☒ Use separate subnets for voice and management

Voice LAN Node IP: [text]
Management LAN gateway IP: [text]
Management LAN subnet mask: [text]
Voice LAN subnet mask: [text]

Last modified:
Last downloaded:
Node sync status:

Comments: [text area]

OK Cancel Apply Help

Configure ITG line card properties

Procedure 10 Configure ITG Line 2.0 card properties

If the IS Manager provides IP addresses and subnet masks in CIDR format, you must convert the data to dotted decimal format. See Appendix D: “Subnet mask conversion from CIDR to dotted decimal format” on page 269 for help.

Note 1: On the Configuration tab, you can Add, Change or Delete the ITG Line 2.0 cards in the node one at a time.

Note 2: You cannot delete the Leader 0 card in the Configuration tab. You must delete the node in order to delete Leader 0.

- 1 Enter the **Card Properties** data for Leader 0, Leader 1 and Follower cards:
 - a. **Define Card role:** Assign the Card role: Leader 0 to the first card you configure. For the second card, assign the Card role: Leader 1. For remaining cards, assign the Card role: Follower.
 - b. **Management IP:** This is also referred to as the E-LAN IP address. Meridian 1 uses this address to communicate with the card.
 - c. **Management MAC:** This is the motherboard Ethernet address from your "ITG Line 2.0 card installation summary sheet" on page 94.
 - d. **Voice IP:** This is the T-LAN IP address for the card. This is also the IP address of the router interface on the T-LAN.
 - e. **Voice LAN gateway IP:** This is the T-LAN Gateway IP address for the card. This is also the IP address of the router interface on the T-LAN.
 - f. **Card TN** - For Large systems, enter Card TN (I s c) information. For Option 11C and 11C Mini, enter only the card number between 0-49. The card TN format is determined by the Meridian 1 system type which is configured in the MAT navigator. You must enter the correct system type in the Mat Navigator **before** you add the node.
- 2 Click **Add**. The card role and address information appears in a list at the bottom of the screen.
- 3 Click **Apply** to add the Card Properties to the Node.

Note: If you prematurely click OK at this point, you will exit from the window and the changes will be saved.

————— *End of Procedure* —————

Figure 16
New ITG Node - Configuration tab

New ITG Node

General | **Configuration** | DSP Profile | SNMP Traps/Routing and IPs | Ports | Security

Define the list of cards for this node. To create the list, enter the values and click Add. Select a card in the list for change, or delete.

Card properties

Card role: Card TN:

Management IP:

Management MAC:

Voice IP:

Voice LAN gateway IP:

Sync status: New

* Card role	Management IP	MAC address	Voice IP	Voice LAN gateway...	Card TN
Leader0	192.162.20.10	00:60:38:01:12:77	192.162.20.20	255.255.255.0	8 1 12

Configure DSP profile data

The following procedure uses the DSP Profile tab and its two sub-tabs to configure DSP profile data. The DSP Profile tab has two sub-tabs - **General** and **Codec Options** that are described briefly below.

General sub-tab description and defaults

DiffServ/TOS - The DiffServ/TOS determines the priority of the packets in the IP network. Allowed values are 0-255. The default is 0 for both control and voice packets. The value entered depends on the equipment in the data network. The TOS applies to all cards.

Loss and Level Plan - Determines parameters, such as transmission gain, that vary from country to country. The Loss and Level Plan values are stored in a file on the MAT/OTM PC. MAT/OTM reads the file to acquire the loss and level values for the selected country and places the values in a config.ini file on the ITG cards.

Enable Echo Canceler checkbox - Do **not** uncheck this box.

Echo canceler tail delay - The delay is 8, 16 or 32 ms. The default is 32.

Voice activity detection - The range is -20 to +10 dB. The default is -17.

Jitter buffer - The range is 0 - 200 ms. The default is 50 ms or the next highest setting that the device allows.

Codec options sub-tab description

The **Codec options** sub-tab presents a table of different sets of codec options identified by a codec index number.

Procedure 11

Configuring DSP profile data

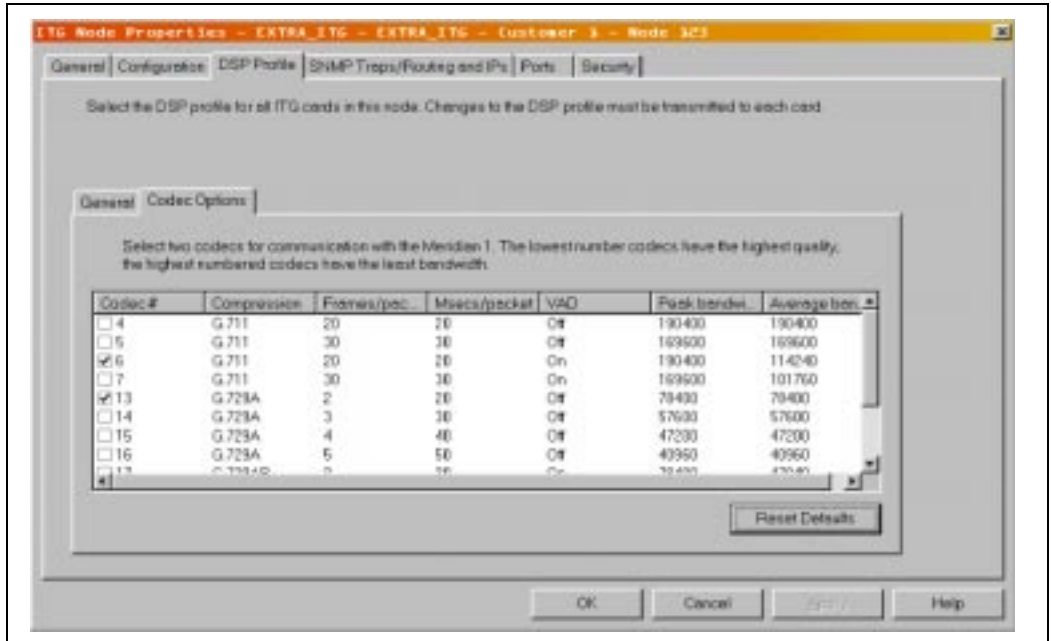
- 1 Click the **DSP Profile** tab if visible. The **DSP Profile** General tab appears.
- 2 Modify the DiffServ/TOS values only if directed to by the IS manager. Otherwise leave the default values.
- 3 Select your country in the Loss and Level plan pull-down box.
- 4 Leave the Codec option as the default setting (recommended).
- 5 Click **Apply** and click the **Codec Options** tab.

Note: DSP Profile Codec Options tab contains a list of up to 32 codecs for the ITG Line 2.0 card (see Figure 17 on page 135)

- 6 Check only two codecs from the list. The default codecs are 4 and 17.
- 7 Click **Apply**.

————— *End of Procedure* —————

Figure 17
New ITG Node DSP Profile tab (General tab)



Configure E-LAN and T-LAN voice port

Procedure 12

Configure E-LAN M1 IP address and T-LAN voice port

- 1 Click on the **Ports** tab.
- 2 Enter the E-LAN M1 IP address and T-LAN voice port (see Figure 18).

Note: The E-LAN M1 IP address must correspond to the active ELNK IP address configured in Overlay 117. It must be in the same subnet as the E-LAN for the ITG Line 2.0 node.

CAUTION

Do not use the Restore Default button. It will change the E-LAN Meridian 1 IP address to an invalid address.

- 3 Change the T-LAN voice port only as instructed by the IP network administrator to improve quality of service for Internet telephony.

Note 1: The T-LAN voice port range is 1024-65535. The default voice ports are 5200 - 5295. A check is performed to prevent the Voice and T-LAN signaling ports from having the same address.

Note 2: The signaling occurs on ports 7300, 4100, 5100 and 5000.

----- *End of Procedure* -----

Figure 18
New ITG Node (Ports tab)

The screenshot shows a window titled "New ITG Node" with a close button (X) in the top right corner. The window has a tabbed interface with the following tabs: General, Configuration, DSP Profile, SNMP Traps/Routing and IPs, Ports (selected), and Security. Below the tabs, there is a text instruction: "Enter the IP addresses and signaling ports. Changes must be transmitted to each ITG". The main area is divided into two sections: ELAN and TLAN. The ELAN section contains three input fields: "Meridian1 IP :" with the value "10.123.124.110", "Signaling port" with the value "15000", and "Broadcast port" with the value "15001". The TLAN section contains two input fields: "Signaling port" with the value "5000" and "Voice port" with the value "5200". Below these sections is a button labeled "Restore Defaults". At the bottom of the window are four buttons: "OK", "Cancel", "Apply", and "Help".

Configure security for SNMP access

This procedure explains how to change the SNMP community names to provide better security for the ITG node. MAT/OTM uses the community name password to refresh the ITG line card status, and to control the transmitting and retrieving of configuration data files for database synchronization.

Note: If you forget the community names, connect a TTY to the ITG card maintenance port. Restart the card. The card displays the community name on the TTY during startup.

Procedure 13

Configuring security for MAT SNMP access

- 1 Click the **Security** tab (see Figure 19 on page 138).
- 2 Change the default Read only and Read/Write default community names. MAT/OTM uses the previous read/write community name to transmit the card properties. The first time you transmit data after changing the password, the Previous read/write password is used. For all following data transmissions, the changed password is used.
- 3 Press **Apply**.

————— *End of Procedure* —————

Figure 19
New ITG Node (Security tab)

Configure SNMP traps

Procedure 14 Configuring SNMP traps

- 1 Click the **SNMP traps** tab in the Node Properties window.
- 2 Check the "**Enable SNMP traps**" checkbox, if you are configuring one or more SNMP management IP addresses to receive SNMP traps from cards in the ITG line node.
- 3 To add an SNMP Manager IP address, type the IP address in the SNMP traps entry fields, and click **Add**. Add SNMP Manager IP addresses for:
 - the local MAT/OTM PC
 - PPP IP address configured in the Netgear RM356 Modem Router, or equivalent, on the E-LAN for the remote support MAT/OTM PC
 - the SNMP manager for remote alarm monitoring
 - Any remote MAT/OTM PCs on the customer's IP network.

Note: A net route or host route through the management gateway is added to the ITG line cards IP Routing Table for each SNMP management address that is added to the SNMP traps list.

- 4 To add a net route or host route through the management gateway for a management host which does not receive SNMP traps, type the IP address and subnet mask in the entry field of the card routing table, and click **Add**.
- 5 Click **OK** to save and exit.

————— *End of Procedure* —————

Figure 20
SNMP traps/Routing and IPs tab

New ITG Node

General | Configuration | DSP Profile | **SNMP Traps/Routing and IPs** | Ports | Security

Define the IP addresses to which SNMP traps will be sent. To create the list, type in the new values and click Add or press enter. Select an item in the list to change or delete.

SNMP traps

☒ Enable SNMP traps

IP address:

Subnet mask:

IP Address	Subnet mask
192.162.20.10	255.255.255.0

Add Change Delete

Card routing table entries

IP address:

Subnet mask:

IP Address	Subnet mask
192.162.20.20	255.255.255.0

Add Change Delete

OK Cancel Apply Help

Configure alarm notification features in MAT

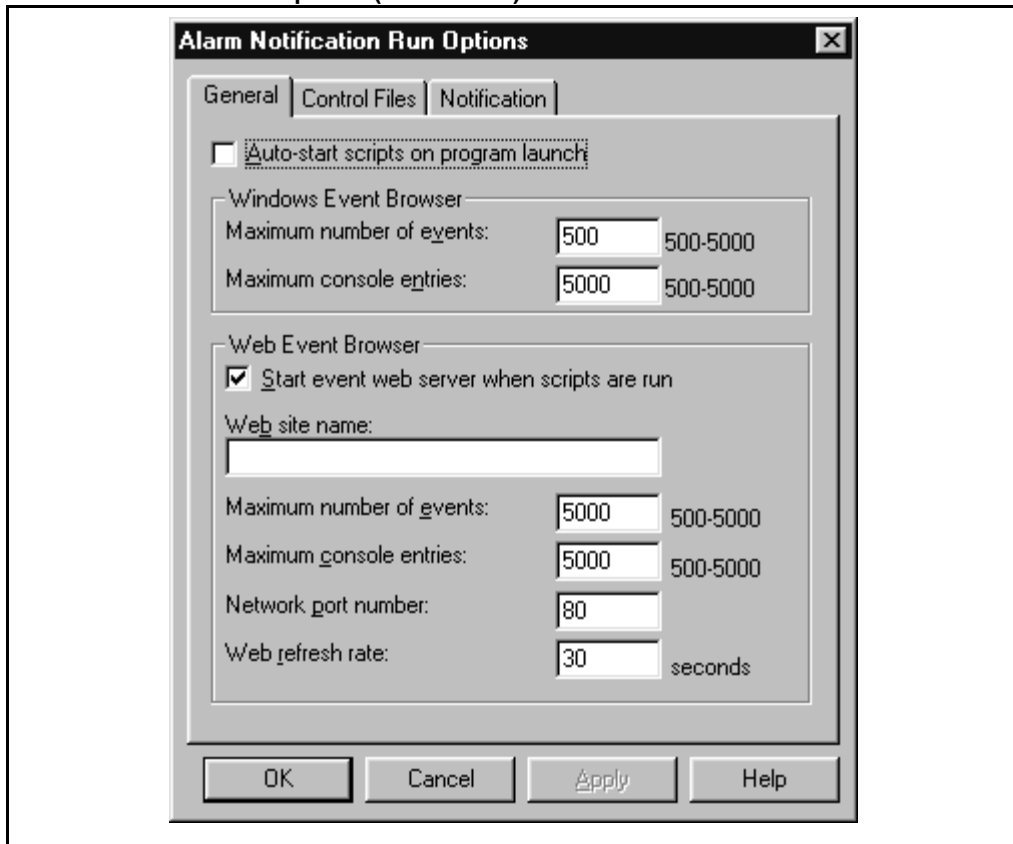
Procedure 15

Configuring MAT/OTM alarm notification feature

- 1 In the MAT/OTM Navigator window menu, select **Utilities | Alarm | Notification**.
- 2 Select **Configuration | Run Options**.

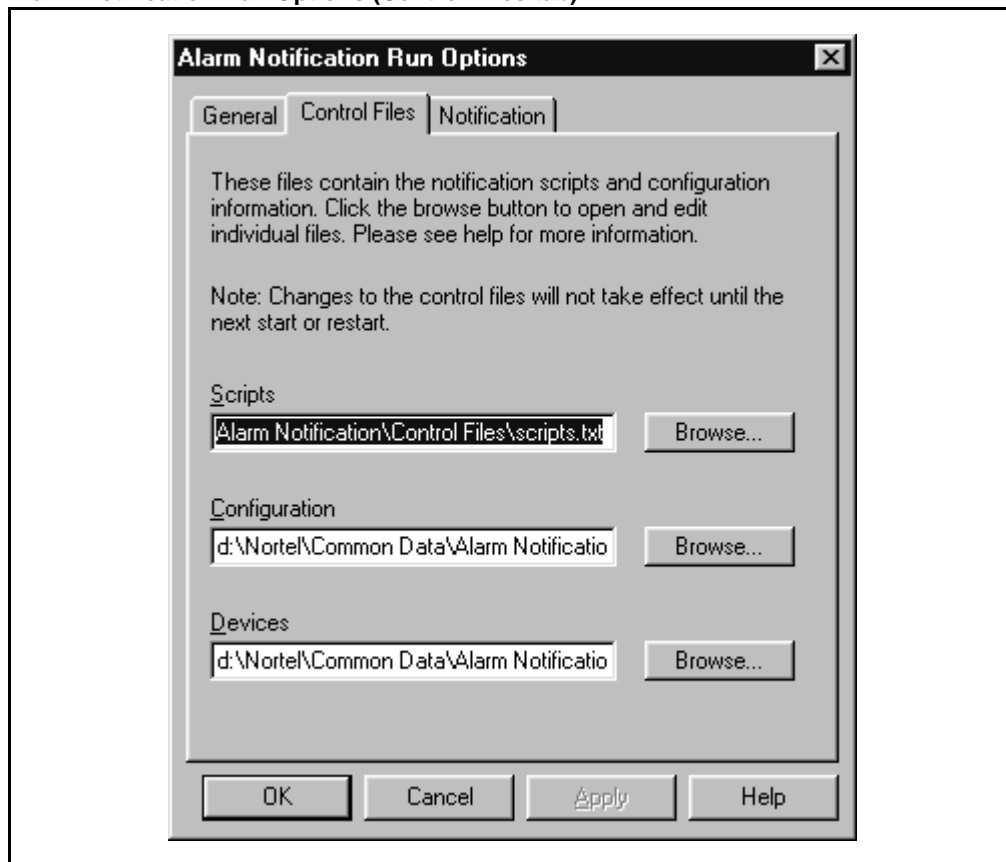
The "Alarm Notification Run Options" dialog box appears (see Figure 21 on page 141).

Figure 21
Alarm Notification Run Options (General tab)



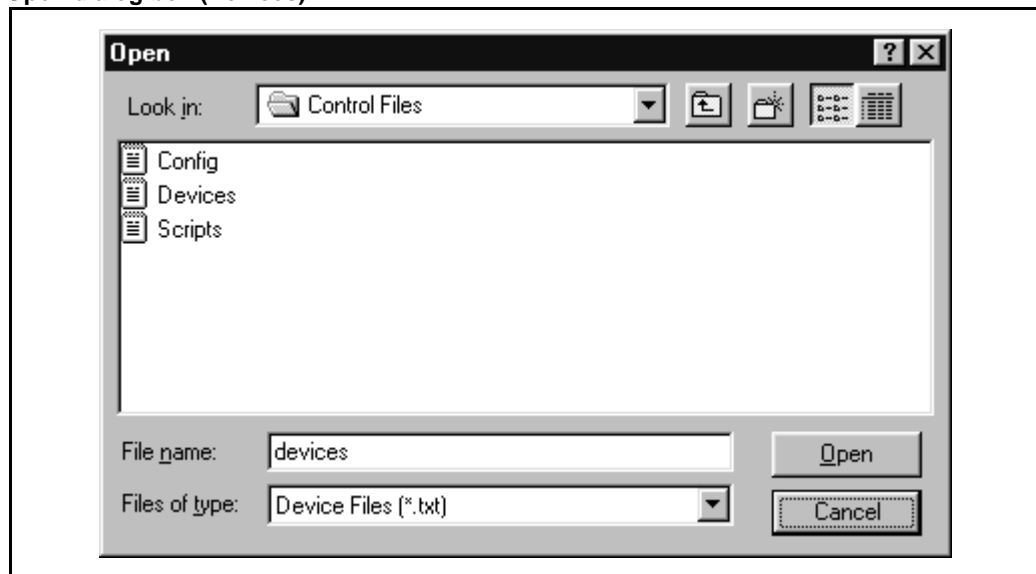
- 3 Click the **Control Files** tab.

Figure 22
Alarm Notification Run Options (Control Files tab)



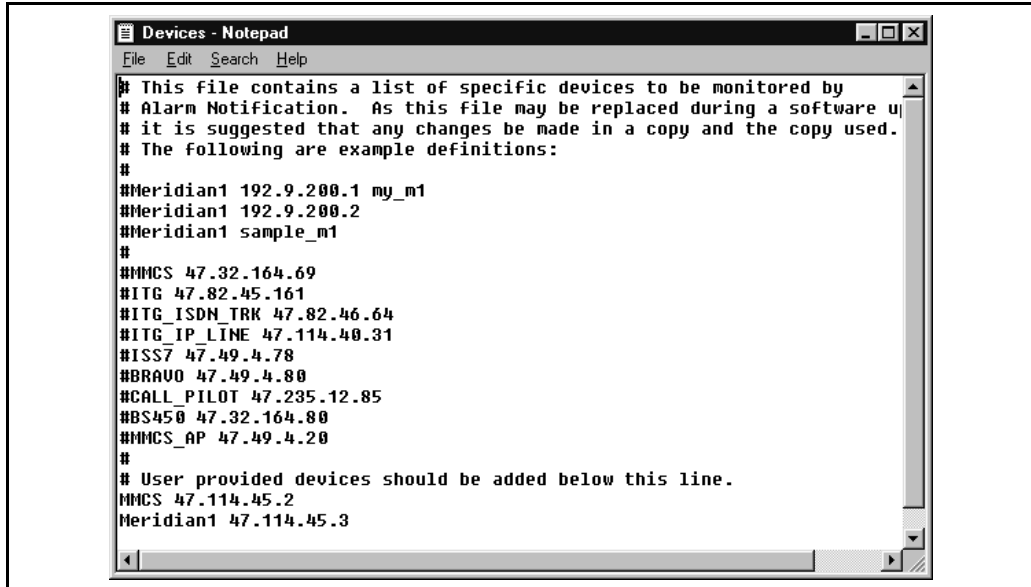
- 4 Click **Devices | Browse**. The "Open" dialog box appears.

Figure 23
Open dialog box (Devices)



- 5 Select the "Devices.txt" file from the "Control Files" folder and click **Open**. The "Devices.txt" file opens.

Figure 24
Devices.txt Notepad



- 6 For each ITG Line 2.0 card in each monitored ITG Line 2.0 card node, add a line consisting of three fields separated by spaces, as shown in Table 24. Enter the first line in the Devices.txt file that begins with a "#" sign.

Table 24
Format of Devices.txt file

Device Type	IP Address	Device Name
ITG_IP_PHONES	xxx.xxx.xxx.xxx	Site_Leader_0
ITG_IP_PHONES	xxx.xxx.xxx.xxx	Site_Leader_1
ITG_IP_PHONES	xxx.xxx.xxx.xxx	Site_Follower_2

- 7 Click **File|Save As** and save as **ITGDevices.txt**.
- 8 In the "Alarm Notification Run Options" window, verify that the devices field name is correct ("ITGDevices.txt")
- 9 Click **Apply** then **OK**.
Note: MAT/OTM Alarm Notification must be restarted whenever Control Files are changed.
- 10 If MAT/OTM Alarm Notification is running, that is, the red traffic light is showing on the tool bar, first stop it by clicking on the red traffic light which then changes to green on the tool bar. Restart it by clicking on the green traffic light which then changes to red.
- 11 If MAT/OTM Alarm Notification is not running, that is, the green traffic light showing on the tool bar, start it by clicking on the green traffic light which then changes to red.

————— *End of Procedure* —————

Transmit ITG line 2.0 card configuration data from MAT to the ITG cards

Before you begin:

- the M1 system is configured to support Internet Telephones and the physical TNs.
- the NTVQ55AA ITG line cards have been installed.
- the E-LAN and T-LAN are configured with access to the IP network.
- the ITG line 2.0 data has been configured on MAT.
- the MAT PC is connected to the local E-LAN subnet or to a remote subnet with IP router access to the E-LAN.

Overview

ITG line nodes and cards are configured in the MAT ITG IP Phones application and then transmitted to the ITG line cards. The configuration data is converted to text files by MAT and transmitted to the line cards. The process consists of the following steps:

- Setting the Leader 0 IP address

- Transmitting the node and card properties to Leader 0
- Transmitting card properties to all cards in the node

Procedure 16

Set the Leader 0 IP address

- 1 Access the ITGL shell by connecting a MAT PC to the RS232 serial maintenance port on the faceplate of the ITG Leader 0 card with an NTAG81CA PC Maintenance cable. If required, use an NTAG81BA Maintenance Extender cable between the PC Maintenance cable and the MAT PC.

Alternatively, connect the NTAG81BA Maintenance Extender cable to the female DB -9 connector of the NTMF94EA E-LAN, T-LAN RS232 Ports cable for a more permanent connection to the ITG card serial maintenance port.

Note: Never connect two terminals to the faceplate and I/O panel breakout cable serial maintenance port connectors at the same time.

- 2 Use the following communication parameters for the TTY terminal emulation on the ITG MAT PC: 9600 baud, 8 bits, no parity, one stop bit.
- 3 Login to the ITGL shell and enter the command **setLeader** to set the Leader 0 Management LAN IP address, Management LAN gateway IP address and the Management LAN subnet mask.
 - a. Enter the same **Management LAN IP** address you entered for **Leader 0** in the **ITG IP Phones** application **Configuration** tab.
 - b. Enter the same **Management LAN gateway IP** address and **Management LAN subnet mask** address you entered in the **ITG IP Phones** application **General** tab.

Note: All ITGL shell commands are case-sensitive. The three parameters must each be enclosed in double quotes. You must put a space after the command, and before the first parameter, and a comma and no spaces between the following parameters.

- 4 Observe the Leader 0 card faceplate maintenance display window:

When the display reads "T:20", it begins to send bootp requests on the E-LAN. A series of dots appears on the TTY.
- 5 Type **+++** and press **Enter**.

- 6 Enter the default "user ID" and "password" of itgadmin to access the ITGL shell command line prompt:
- ```
...+++
user ID: itgadmin
password: itgadmin
```
- 7 When the maintenance window displays "T:21", at the ITGL shell prompt, enter:
- ITGL> **setLeader** "xx.xx.xx.xx","yy.yy.yy.yy","zz.zz.zz.zz",  
**where:**
  - "xx.xx.xx.xx"=IP address. Enter the same IP address you entered in the **Management LAN IP** field for **Leader 0** in the **ITG IP Phones Configuration** tab.
  - "yy.yy.yy.yy"=Gateway IP address. Enter the same address you entered in the **Management LAN gateway IP** field in the **ITG IP Phones General** tab.
  - "zz.zz.zz.zz"=Management LAN subnet mask. Enter the same address you entered in the **Management LAN subnet mask** in the **ITG IP Phones General** tab.
- Note:** This step assumes you have already configured MAT.
- 8 Reboot Leader 0.
- 9 Check the maintenance display for T:22 to confirm a successful reboot.

---

*End of Procedure*

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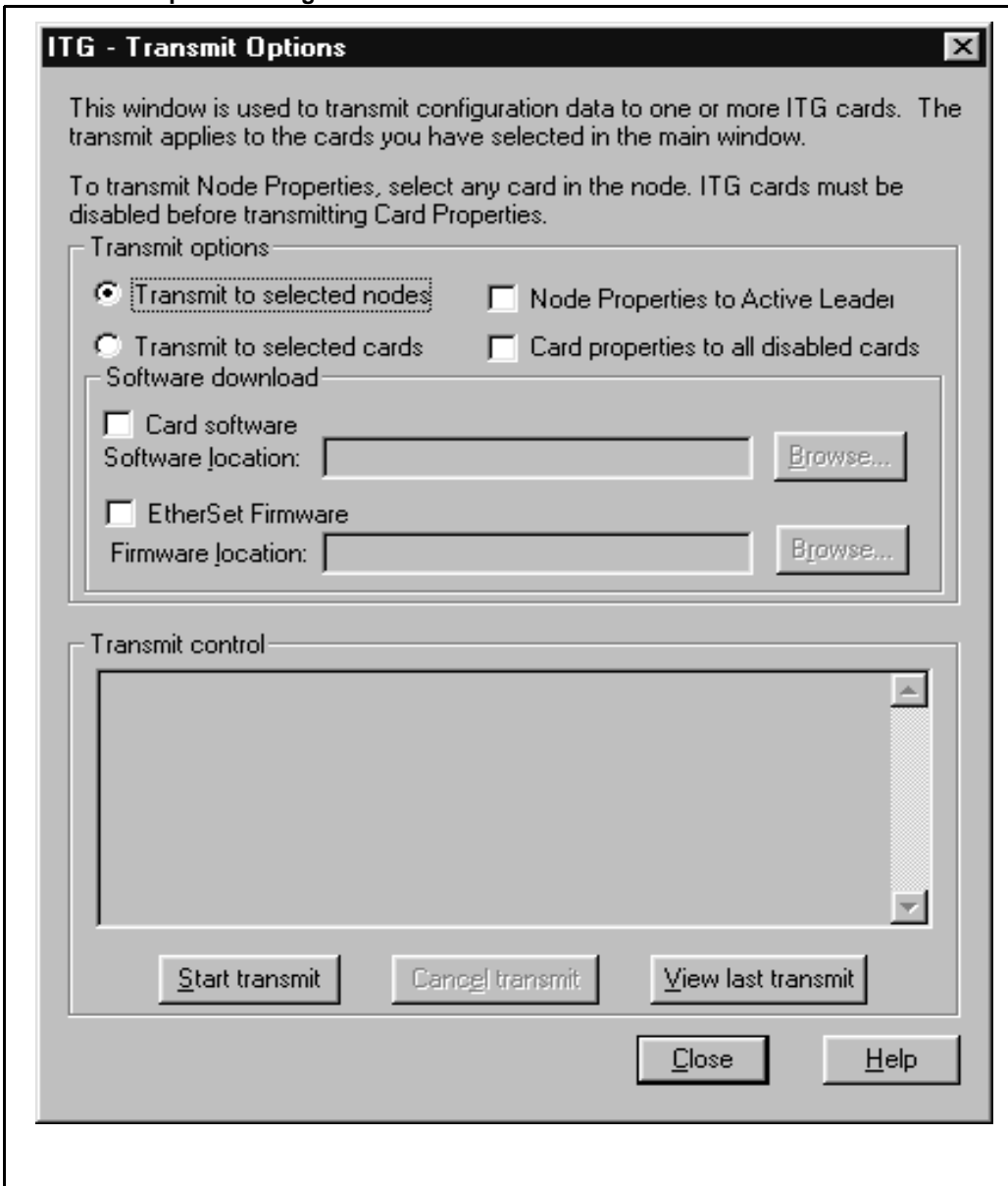
### Procedure 17

#### Transmit node and card properties to Leader 0

- 1      Log in to Overlay 32 in Meridian 1. Disable the card in order to transmit the card properties.
- 1      Open MAT/OTM. From the **MAT Navigator** window double-click on **ITG IP Phones**. The **IP Telephony Gateway - IP Phones** window opens.
- 2      Select the ITG line node from which you want to transmit properties from the list in the upper part of the window.
- 3      Click **Configuration | Synchronize | Transmit**. The “ITG - Transmit Options” window appears (see Figure 25).
- 4      Leave the radio button default setting of “**Transmit to selected nodes**”. Check the “**Node Properties and Card Properties**” check boxes.
- 5      Click the **Start Transmit** button. Monitor progress in the “Transmit Control” window. Confirm that the node and card properties are transmitted successfully to Leader 0.  
  
**Note:** It is normal at this point, that the card properties fail to transmit to the other cards in the node, because the IP address has not been assigned from Leader 0.
- 6      When the transmission is complete, click the **Close** button.
- 7      Reboot the Leader 0 ITG Line 2.0 card. At the ITGL prompt, enter: **cardReset** or push the reset button on the ITG line card faceplate.

————— *End of Procedure* —————

**Figure 25**  
**ITG Transmit Options dialog box**



### Procedure 18

#### Transmit card properties to all cards in the node

To verify installation and configuration:

- 1      Check card faceplate displays.
  - After successfully rebooting, the Leader 0 card is now fully configured with the Node Properties of the node and enters a state of "active leader". The Card faceplate display shows **Lxxx**, where xxx = the number of i2004 sets registered with the terminal proxy server on the Leader card.
  - The Leader 1 card, in MAT, and any follower cards receive their configuration from the Leader 0 card. The faceplate display shows **Fxxx**, where xxx = the number of i2004 sets registered with the terminal proxy server on the Leader card.
- 2      Select the new ITG node from the list in the upper part of the main window. All ITG cards in the node are displayed in the lower part of the window. While the node is selected, from the card list, press function key **F5** or **View | Refresh | Selection** to refresh the card status of all cards in the selected node. The card status changes from "unknown" or "not responding" to "disabled" or "enabled unequipped".

**Note:** If you cannot communicate with the node after transmitting the node properties and rebooting the Leader 0 card, this means that the ITG cards are unable to communicate back to the remote MAT/OTM ITG PC through the voice gateway.

To re-establish communication with the ITG node:

- a.    verify the T-LAN physical and logical connections on all the non-responsive cards. Check:
  - i.    cables plugged securely into the correct connection
  - ii.   hub or switch is connected to correct router
- c.    connect to the ITG line card maintenance port and use the ITGL shell 'routeAdd' command on each ITG line card to add a new IP route, via the management gateway, that points to the remote MAT/OTM ITG PC subnet.
- d.    Repeat **step a** every time a card is reset until the card properties (containing the SNMP Manager IP addresses and the card routing IP addresses) have been successfully transmitted to the card.

- 3 Transmit card properties again to Leader 1 and follower cards. If any of the cards are not status "disabled", go into Overlay 32 and disable the card.
- 4 When all card TNs show a status of disabled, go into **Configure | Synchronize | Transmit**. When the Transmit window opens, click the radio button "**Transmit to selected nodes**" and click option to transmit the card properties.
- 5 Click "**Start Transmit**". Carefully monitor the progress carefully to verify that the card properties are successfully transmitted to every ITG line card in the selected node identified by its TN.

————— *End of Procedure* —————

## Upgrade the ITG Line card software and i2004 set firmware

Before upgrading your software and firmware, check which version of card software and i2004 set firmware is currently installed. Compare this to the latest versions available by accessing the Meridian 1 Electronic Software Documentation (ESD) website. Refer to Procedure 20 on page 152 for more details.

If a software upgrade is required, the preferred method of software delivery is directly from the M1 ESD website. Alternatively, when web access is restricted or unavailable, the latest software can be pre-loaded onto a disk and inserted directly into the PCMCIA card slot on the faceplate of the ITG line card.

### **Procedure 19**

#### **Verify card software and i2004 Internet Telephone firmware**

- 1 In the ITG IP Telephone main window, select an ITG 2.0 node. A list of all line cards for that node appears in the lower part of the window.
- 2 Starting with the Leader 0 ITG Line 2.0 card, double-click each ITG Line 2.0 card to open the IP Telephony Gateway Line 2.0 card Properties window.
- 3 Leave the default selection of the ITG Line 2.0 card in the Card Properties window, and click the "Configuration" tab. The software and firmware releases are displayed on this tab.

- 4      Note the software and i2004 Internet telephone firmware release of each ITG Line 2.0 card and compare it against the latest recommended software release for the card available on the M1 ESD website.

The website URL is:

**"<http://www.nortelnetworks.com/servsup/esd/meridian1/>".**

The steps required to navigate through the M1 ESD website are contained in Procedure 20 on page 152.

**Note:** Information on the latest software and i2004 Internet Telephone firmware versions is contained in the **Release Notes** of the associated zipped files available on this website.

- 5      If any of the cards require a card software or i2004 firmware upgrade, refer to Procedure 21, "Upgrade ITG Line card software from the web" on page 153, or Procedure 23, "Upgrade i2004 Internet Telephone firmware" on page 156.

————— *End of Procedure* —————

#### **Procedure 20**

##### **Navigate through the M1 ESD website**

- 1      Open a web browser on the MAT PC and connect to the following URL: "<http://www.nortelnetworks.com/servsup/esd/meridian1/>".
- 2      Click on the **Login now** link.
- 3      Click OK, repeatedly, to advance through authentication screens.
- 4      At the login screen, enter your Username and Network password.  
  
**Note:** If you are not registered with the M1 ESD website, refer to the generic Release 25 product bulletin for directions on how to register.
- 5      When the Meridian 1 Distribution System screen appears, click on the **IP Telephony** link.
- 6      From the Meridian 1 IP Telephony pull-down menu, select IP\_Telephones.
- 7      A table labeled "**ITG Line-side 2.0 - Internet Telephone**" appears. The File Name column contains a zipped file with the latest software version imbedded in its filename.



- 8 Click on the pdf file in the Documentation column to download the text file associated with the latest card software.
- 9 Open the readme.txt file that contains the version number of the latest card software and associated i2004 firmware.

————— *End of Procedure* —————

## **Procedure 21**

### **Upgrade ITG Line card software from the web**

- 1 If not already open, from the MAT/OTM PC open a web browser and connect to the following URL address:  
**<http://www.nortelnetworks.com/servsup/esd/meridian1/>**
- 2 When you are connected to the site, enter the username and password.  
**Note:** If you are not registered with the M1 ESD website, refer to the generic Release 25 product bulletin for directions on how to register.
- 3 Select the latest recommended software version files and the location on the MAT/OTM PC hard drive to where it is to be downloaded. Record the MAT/OTM PC hard drive location for use later in the procedure.
- 4 Download and unzip the software file.
- 5 Open MAT/OTM and launch the “ITG IP Phones” application, if it is not already open.
- 6 Select the ITG cards from the main card list view that are to be upgraded. Upgrade all the cards in the node together, unless you are installing a spare card that has older software.
- 7 Disable all ITG Line 2.0 cards to be upgraded. Use the Meridian 1 Overlay 32 DISI command from MAT/OTM Maintenance Windows, the MAT/OTM System Passthru terminal, or from a Meridian 1 system management terminal directly connected to a TTY port on the Meridian 1.
- 8 In the MAT/OTM “**IP Telephony Gateway - IP Phone**” main window, select **View | Refresh** and verify that the card status is showing “Disabled.”
- 9 Select **Configuration | Synchronize | Transmit**. The “ITG - Transmit Options” dialog box is displayed.

- 10     In the “Transmit Options” group box, select the radio button “Transmit to selected cards.”
- 11     In the “Software Download” group box check “Card software.”
- 12     Click on the **Browse** button to locate the ITG Line 2.0 card software that was downloaded earlier from the website. Select the software file and click **Open** to save the selection. The path and file name of the ITG Line 2.0 card software appears in the edit box next to the “Browse” button.
- 13     Click on the **Start Transmit** button to begin the ITG Line 2.0 card software upgrade process.  
  
The software is transmitted to each card in turn, and burned into the flash ROM on the ITG Line 2.0 card.
- 14     Monitor progress in the “Transmit Control” window. Confirm that the card software is transmitted successfully to all cards. Note any error messages, investigate, correct any problems, and repeat card software transmission until it is completed successfully on each ITG Line 2.0 card. The cards continue to run the old software until they are rebooted.
- 15     Reboot each ITG Line 2.0 card that received transmitted software, so that the new software can take effect. Start the rebooting with Leader 0, then Leader 1, and the follower cards. After all ITG Line 2.0 cards have been reset, have successfully rebooted, and are responding again to the MAT/OTM ITG, do a **Status refresh** (disabled: active; disabled: backup; disabled).  
  
**Note:** These cards must remain in the “Disabled” state after the upgrade, so that the technician can issue a “Reset” command from the Maintenance menu, or the “Maintenance” tab, in the “IP Telephony Gateway Line 2.0 card Properties” window to each card, to reboot them. Alternatively, the cards can be reset by using a pointed object to press the “Reset” button on the card faceplate.
- 16     Double-click each upgraded card and verify the software version on the “Configuration” tab of the Card Properties.

- 17 Use the Overlay 32 ENLC command to re-enable the ITG Line 2.0 cards.
  - a. Use LD 32 via the TTY or MAT/OTM overlay passthru to enable the ITG Line 2.0 cards with one of the following commands:
    - **ENLC I s c.** (For Meridian 1)
    - **ENLC c** (for Option 11C or 11C mini)
- 18 Repeat the above steps for each ITG Line 2.0 card.

————— *End of Procedure* —————

## **Procedure 22**

### **Upgrade ITG card software by PC card**

This procedure provides an alternate to the web method of upgrading card software described in Procedure 21 on page 153. In this case, Nortel Networks supplies a PC card containing the latest ITG card software version.

- 1 Insert the PC card containing the software into the A: drive of the ITG card, located on the faceplate of the card.
- 2 From the ITGL shell on the MAT PC, monitor the successful insertion of the PC card. There will be a message that indicates that the card has been successfully recognized and installed.
- 3 Use the **swDownload** command to copy the software from the PC card to the ITG card flash ROM device, using the FTP client and the FTP host on the card. The host name parameter in this command is the management interface IP address of the ITG card. The user name and password are the same as configured for the ITG shell. The directory path, which is "/A:", and file name indicate the software file on the PC card in the A: drive.
- 4 Press **Enter**. Monitor the status of the software upgrade, and check that the upgrade correctly finishes. Observe any error messages that indicate problems with parameters or syntax.
- 5 When the new software has downloaded into the flash ROM device, you must reboot the ITG line card to use it. Use the **cardReset** command or press the reset button on the card faceplate.

————— *End of Procedure* —————

### Procedure 23

#### Upgrade i2004 Internet Telephone firmware

- 1      Open a browser on the MAT/OTM PC and connect to the following URL address:  
  
         **<http://www.nortelnetworks.com/servsup/esd/meridian1/>**
- 2      When you are connected to the site, enter the username and password.  
  
         **Note:** If you are not registered with the M1 ESD website, refer to the generic Release 25 product bulletin for directions on how to register.
- 3      Select and download the latest recommended firmware version zip file into the location on the MAT/OTM PC hard drive where it will be unzipped. Record the MAT/OTM PC hard drive location for use later in the procedure.
- 4      Open MAT/OTM and launch the “ITG and IP Phones” application, if not already opened.
- 5      Select the ITG cards, for upgrading, from the main card list view. Upgrade all the cards in the node together, unless you are installing a spare card that has older software.  
  
         **Note:** You do **not** need to disable the cards to update the firmware.
- 6      Select **Configuration | Synchronize | Transmit**. The “ITG - Transmit Options” dialog box is displayed.
- 7      In the “Transmit Options” group box, select the radio button “Transmit to selected node”.
- 8      In the “**Ethernet Firmware Download**” group box check “**Card firmware**.”
- 9      Click on the **Browse** button to locate the ITG Line 2.0 card firmware that was downloaded from the M1 ESD website. Select the firmware file and click **Open** to save the selection. The path and file name of the ITG Line 2.0 card firmware appears in the edit box next to the “Browse” button.
- 10     Click on the **Start Transmit** button to begin the ITG Line 2.0 card firmware upgrade process.

The firmware is copied to the C:\ drive of the MAT PC.

- 11 The i2004 Internet Telephones continue to run the old firmware until the **umsUpgradeAll** command is executed or the i2004 Internet Telephone re-registers with the ITG line card.
- 12 Verify the time and the date on each ITG card before proceeding to the next step.
- 13 Telnet into each line 2.0 card at the ITG line command, and enter:  
**umsUpgradeAll "hh:mm/p"**  
where hh:mm/p specifies the time when the upgrade will occur.  
  
At the specified time, all the i2004 Internet Telephones on the ITG node go out of service. This may take several minutes. Upon completion of the firmware upgrade, the i2004 Internet telephones are brought back on-line in groups of ten.

#### **CAUTION**

Without the "hh:mm/p" parameter, the umsUpgradeALL command will cause the i2004 Internet Telephones to be taken out of service immediately.

- 14 Double-click on each ITG card, and enter:  
**isetInfoShow**  
to verify the upgraded i2004 Internet Telephones.
- 15 For any i2004 Internet telephones which did not upgrade successfully, power on and off the set.

————— *End of Procedure* —————



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# ITG MAT 6.67.07 (with update disk)/OTM 1.0 management PC

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## Contents

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## Overview

This section provides guidelines on how to set up MAT 6.67.07 (with update disk)/OTM 1.0 to support the Meridian Internet Telephony Gateway (ITG) Line 2.0 card and i2004 Internet Telephone. The MAT 6.67.07(with update disk)/OTM 1.0 application name is **ITG IP Phones**.

**Note:** For the remainder of this chapter, MAT 6.67.07(with update disk)/OTM 1.0 is referred to as MAT/OTM.

## ITG Engineering rules

MAT/OTM ITG can manage multiple nodes with multiple ITG cards. The maximum number of ITG cards that can be configured depend on the following:

- 1 All MAT/OTM ITG data is stored in a single database file. The entire database is read into PC memory when you launch the program. If a large ITG network is to be managed from a single MAT/OTM server, then each client must have more than 32 Mb RAM. If the data is stored on a MAT/OTM server, the application launch time increases as the size of the ITG network grows (this also depends on the network speed).
- 2 In theory, a single MAT/OTM installation can support up to 500 Meridian 1s. However, MAT 6.6/OTM applications that require real time, such as Traffic Analysis retrieval of traffic data, are limited to a much smaller number of systems.
- 3 MAT/OTM Alarm Notification can receive a maximum of 20 SNMP traps per second (based on the recommended PC configuration). In large networks, it is recommended that multiple MAT/OTM PCs be used to collect traps from ITG cards, each PC supporting one or more ITG nodes. Alarm notification scripts can be used to forward critical alarms to a central MAT/OTMMAT/OTM PC or Network Management application.

## Network setup guidelines

Install MAT/OTM in a standalone mode or in a network environment. For ITG Line 2.0 card, install MAT/OTM in a network environment, so you can manage multiple ITG nodes, provide multi-user access, and maintain ITG configuration data consistency.

In the network environment, MAT/OTM stores databases on a file server. Do not use the server to access MAT/OTM as a client PC. MAT/OTM with Windows 95 or Windows NT 4.0 clients are supported on:

- Novell 3.12 or later server
- Windows NT server
- OTM 1.0 client requires an OTM server

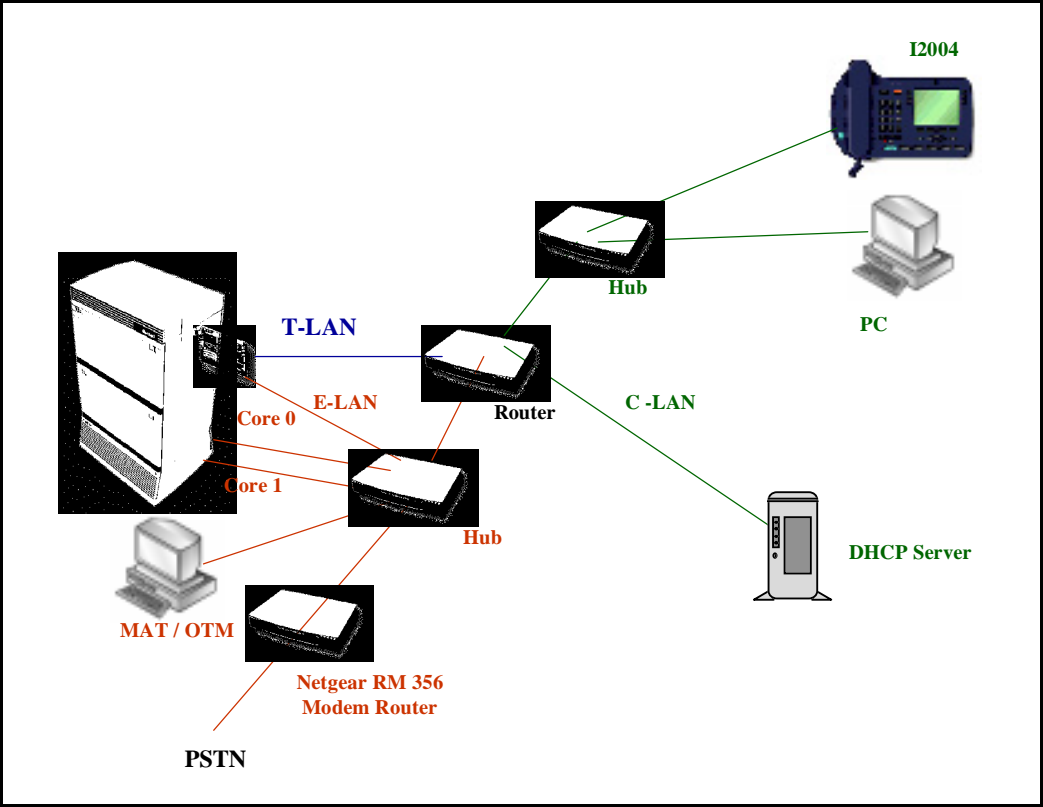


## Remote Access configuration

Support for remote access varies according to the support organizations access to the customer's data network LAN or WAN. There are three possible remote access scenarios. Refer to Figure 26 on page 162 for an illustration of remote access configuration.

- Customer provides an authenticated RAS account to all E-LANs and router interfaces for full access to the customer's network.
- Install dial-up modem routers on the E-LANS and configure access to the customer's T-LAN in a secure manner.
- Connect an ordinary modem to the ITG line card serial port for limited access to the ITG line card configuration using Advanced Methods (not MAT). This provides a read-only solution.

Figure 26  
Remote access with full access to the customer's LAN/WAN



## PC description

The MAT/OTM PC can be attached to a LAN to provide multi-user, multi-site access. The MAT/OTM applications and database must reside on a LAN Server with each client accessing the files from the server.

**Note:** The server used for MAT/OTM is used as a file server only and must not be used to access MAT/OTM as a client PC.

A single network drive location is chosen during the MAT/OTM client PC installation process. For multi-system configurations where large data store requirements exceed the capacity of a single drive, or where data integrity is highly valued, a Redundant Array of Inexpensive Disks (RAID) storage solution is recommended. Tape, or other types of backup, is recommended.

When you install MAT/OTM client applications, it is important for the network drive to be mapped the same way from each PC if a MAT/OTM user is expected to be able to login to the network with their network login ID at any MAT/OTM client PC.

A PC security device is required for every PC running MAT/OTM. A security device is not required for the PC server as it is only used to store MAT/OTM data and does not actually run any MAT/OTM applications.

Each of the MAT/OTM client PCs on the customer LAN is allowed connectivity to IP addresses of the Meridian 1s:

- 1** MAT/OTM client PC in a switchroom (on the E-LAN subnet) has access to the File Server on the customer network.
- 2** Block broadcast messages from the C-LAN to the E-LAN.
- 3** Block access to the E-LAN from non-MAT/OTM client PCs for security reasons.

## PC hardware and software requirements

The list below is the minimum PC hardware and software requirements to run MAT/OTM. Other applications launched while you use MAT/OTM can require increased RAM:

- A Pentium Processor PC with:
  - 100 MHz or faster CPU

— One GB or larger hard disk drive with 500 MB or more free space (includes Windows 95/NT 4.0 requirements). Please refer to system datastore column in the hard drive requirements chart that follows:

- 32 MB RAM (minimum)
- SVGA color monitor and interface card (800x600 resolution for graphics)
- 3-1/2 inch 1.44 MB floppy disk drive
- Windows 95 or Windows NT 4.0 with Microsoft TCP/IP installed
- Ethernet Network Interface Card
- Hayes-compatible modem is optional to connect to remote systems, required for polling configurations (9600 bps or better is recommended)
- PC COM port with 16550 UART
- Parallel printer port. Configure a printer even through it is not required to be attached to the PC.
- Two-button Windows compatible mouse or positioning device
- CD-ROM drive

## Hard drive requirements

For a single MAT/OTM PC configuration, refer to Table 25 to select the hard drive space required on the MAT/OTM PC. Consider both program and data store requirements.

For MAT/OTM client configurations (two or more MAT/OTM PCs sharing the same database), the common data is stored on a server PC that does not run MAT/OTM. Estimate the size of the required disk space on this server using the Data Store column in Table 25.

**Table 25**

### Hard drive capacity for MAT/OTM applications

| MAT/OTM application                      | Program store | Data store                                                                          |
|------------------------------------------|---------------|-------------------------------------------------------------------------------------|
| Common services (required)               | 38 MB         | Negligible.                                                                         |
| ITG                                      | 1.5 MB        | 1.0 MB plus 0.5 MB per 1k ITG cards                                                 |
| Traffic Analysis                         | 5 MB          | Meridian 1 dependent: Typically 2.5 to 9 MB per month for each system traffic data. |
| ESN                                      | 1 MB          | Meridian 1 dependent: Allow 1 MB per customer.                                      |
| Maintenance Windows                      | 1 MB          | Negligible.                                                                         |
| Alarm Management with Alarm Notification | 1.5 MB        | Negligible.                                                                         |



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# Installation and maintenance of i2004 Internet Telephone

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## Contents

This section contains information on the following topics:

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## Overview

This chapter explains how to install the i2004 Internet Telephone and how to perform some maintenance tasks.

The following procedures are contained within this chapter:

- Procedure 24, “Pre-installation checklist” on page 168.
- Procedure 25, “Manual first-time installation of the i2004 Internet Telephone” on page 169.

- Procedure 26, “Automatic first-time installation of the i2004 Internet Telephone” on page 172.
- Procedure 27, “Changing the TN of an existing i2004 Internet Telephone” on page 173.
- Procedure 28, “Replacing an i2004 Internet Telephone” on page 174.
- Procedure 29, “Taking an i2004 Internet telephone out of service” on page 174

## **Before you begin**

### **Procedure 24**

#### **Pre-installation checklist**

- 1     Make sure you have one NTEX00BA i2004 Internet Telephone Boxed Package for each i2004 Internet Telephone. The Boxed Package contains:
  - NTEX00AA i2004 Internet Telephone
  - A0648375 7 foot Ethernet cable, Category 5
  - PO910803 i2004 Quick Reference Card
  - A0619627 Power Transformer (117/120 Vac 50/60 Hz)
  - A0788874 Telephone Handset (Ethergray)
  - A0788682 Telephone Handset Cord (Ethergray)
  - P0886045 Telephone footstand
- 2     Make sure you have the following:
  - A dedicated 10BaseT or 100BaseT or 10/100BaseT Ethernet interface.
  - A small desktop hub or switch if you are sharing your existing desktop Ethernet connection with your PC.
  - A local power supply appropriate for the voltage in your area.



- 3** You must be familiar with the three configuration modes that you will be prompted to choose from as you proceed through the installation of your i2004 Internet Telephone:

- Partial DHCP mode: works with standard DHCP server
- Full DHCP mode: requires special configuration of the DHCP server to recognize the i2004 Internet Telephone
- Manually configured static IP address: available IP address for static assignment of i2004 Internet Telephone. Your IP Network Administrator provides this address.

**Note 1:** If you chose Partial or Manual configuration mode, you have to configure connect service parameters.

**Note 2:** The IP address for connect servers 1 and 2, Node ID and VTN must be provided by the Meridian 1 System Administrator.

————— *End of Procedure* —————

## Manual first-time i2004 Internet Telephone installation

To install and configure an i2004 Internet Telephone, you must first install an ITG Line 2.0 card on the Meridian 1 host. The i2004 Internet Telephone application must be running on the card.

### Procedure 25

#### Manual first-time installation of the i2004 Internet Telephone

- 1** Configure a virtual loop on the Meridian 1 using LD 97.
- 2** Configure the i2004 Internet Telephone on Meridian 1 using LD 11.
- 3** Connect the i2004 Internet Telephone components:
  - a** Connect one end of the handset cord to the handset jack on the back of the telephone identified with a handset icon.
  - b** Connect the other end of the handset cord to the handset.

- c    Connect one end of the CAT-5 line cable to the Ethernet jack on the back of the telephone. The other end plugs into the IP voice network (Ethernet), using a RJ45 connector.

**CAUTION**

**Do not plug your i2004 Internet Telephone into an ISDN connection. Severe damage can result. Consult your system administrator to ensure that you are plugging your set into a 10/100BaseT Ethernet jack.**

- d    Plug the AC Power adapter into the connection on the back of the telephone. Be sure to thread the cord around the strain relief, retaining hook, and channel provided for a secure power connection.
  - e    Plug the AC power adapter into the nearest power outlet. Check your i2004 Internet Telephone User Guide for country-specific parameters.
- 4    Secure the telephone footstand to the base of the telephone. Use the angle adjustment grip on the top back of the telephone to adjust the position.

**IMPORTANT**

**Before plugging in your i2004 Internet Telephone, read the following important timing information:**

There are only **four seconds** between plugging in the i2004's power transformer and the appearance of the Nortel Networks logo on the display. When you see the logo, you have **one second** to respond by pressing the four feature keys at the bottom of the display in sequence from left to right. If you miss the one second response time, the i2004 will start trying to locate the connect server. You will have to wait until it is finished, and then begin the power up sequence again.

- 5 Power-up the i2004 Internet Telephone.
- 6 When the Nortel Networks logo appears on the display, immediately press the four feature keys at the bottom of the display in sequence from left to right.
- 7 At the prompt "DHCP Yes/No?", enter "**No**" for manual configuration.
- 8 Enter a valid i2004 Internet Telephone IP address, subnet mask, and router IP address (Gateway) for the i2004 Internet Telephone on the LAN segment to which it is connected.
- 9 Enter the Node IP address of the ITG i2004 Line node at the S1 IP prompt. Continue entering the following information for the S1 server:
  - S1 Port: 4100
  - S1 Action: 1
  - S1 retry count: 10
- 10 You are now prompted for S2 information. Enter the same IP address, port number, action and retry count as for connect server 1 (above).
- 11 The i2004 Internet telephone searches for the connect server. When the connection is complete, enter the Node ID and the TN or VTN.
- 12 The i2004 Internet Telephone begins the firmware download. This takes several minutes. When complete, the i2004 Internet Telephone resets itself.
- 13 You are now prompted for the DHCP mode: 0 - Full, 1 - Partial:  
**Note:** Partial DHCP mode does not require any special configuration of the DHCP server. Full DHCP mode requires special configuration of the DHCP server to recognize the i2004 Internet Telephone.
- 14 The Meridian 1 logo, date and time appears on the top line of the display when the manual configuration is complete.
- 15 Check for dial tone and the correct DN above the display. Manual configuration is complete.

————— *End of Procedure* —————

## Automatic first-time installation of an i2004 Internet Telephone

Automatic configuration of the i2004 Internet Telephone client requires an i2004 Internet Telephone-aware DHCP server. DHCP allows the dynamic allocation of IP addresses to different clients.

The Nortel Networks i2004 Internet Telephone can act as a DHCP client. As part of the startup routine, the i2004 Internet Telephone can request automatic network and local configuration parameters from a DHCP server. The DHCP server responds to the request and supplies information.

Network configuration parameter requests include:

- IP address of the i2004 Internet Telephone
- Subnet mask for the i2004 Internet Telephone IP address
- Default gateway for the i2004 Internet Telephone LAN segment

Local configuration parameter requests include:

- A command (UNISTim Hello)
- IP address of the ITG Line 2.0 node Active Leader. The ITG Line 2.0 card acts as a bootstrap server to download the most recent version of the i2004 Internet Telephone firmware, if required. The Active Leader gives the IP address of the Terminal Proxy Server (TPS) through which the i2004 Internet Telephone registers with the Meridian 1.
- Number of retries for the primary and secondary bootstrap server.

To install and configure an i2004 Internet Telephone, the host Meridian 1 must be installed with the ITG cards, and the ITG cards must be running the i2004 Internet Telephone application. A DHCP server and DHCP relay agents, if necessary, must also have been installed, configured and running.

### Procedure 26

#### Automatic first-time installation of the i2004 Internet Telephone

- 1        Configure a virtual loop on the Meridian 1 using LD 97.
- 2        Configure the i2004 Internet Telephone on Meridian 1 using LD 11.

- 3 Follow the steps in "Manual first-time i2004 Internet Telephone installation" on page 169 to install the footstand, Ethernet cable, power transformer, handset, handset cord.
- 4 Power-up the i2004 Internet Telephone.
- 5 Connect the i2004 Internet Telephone to the LAN using the supplied Ethernet cable. The i2004 Internet Telephone automatically proceeds through its DHCP sequence.
- 6 The i2004 Internet Telephone prompts you for a node number and TN. Enter the node number and TN on the keypad.
- 7 Automatic i2004 Internet Telephone configuration is complete.  
  
If the TN has not been previously configured on Meridian 1 or an invalid TN is used, a message is displayed on the screen of the i2004 Internet Telephone indicating "Invalid TN."

————— *End of Procedure* —————

## **i2004 Internet Telephone power cycle description**

The power cycle is similar to the initial installation. The i2004 Internet Telephone saves its firmware, IP parameters, Node Number and TN in memory. As the i2004 Internet Telephone proceeds through a start-up sequence it does not need to re-enter the IP parameters if they were manually entered. It does not need to reacquire firmware or prompt the user for Node Number and TN.

## **Reinstall an i2004 Internet Telephone**

You can reuse an existing, previously-configured i2004 Internet Telephone on the same Meridian 1. For example, the i2004 Internet Telephone can be assigned to a new user (new TN) or to an existing user who moved to a new subnet.

## **Change the TN of an existing i2004 Internet Telephone**

### **Procedure 27**

#### **Changing the TN of an existing i2004 Internet Telephone**

- 1 Power-cycle the i2004 Internet Telephone.
- 2 During the reboot sequence of a previously-configured i2004 Internet Telephone, the i2004 Internet Telephone displays the existing node number and TN for approximately five seconds.

- 3      Press the "Clear" softkey during the five-second period. The existing node and TN will be cleared.
- 4      The i2004 Internet Telephone prompts the user for new Node Number and TN information.

————— *End of Procedure* —————

## Replace an i2004 Internet Telephone

### Procedure 28

#### Replacing an i2004 Internet Telephone

- 1      Use the Manual or Automatic first-time installation procedures, Procedures 25 and 26, described in this chapter to install and configure the i2004 Internet Telephone.
- 2      Enter the same TN and Node Number as the i2004 Internet Telephone you replaced. Meridian 1 ITG gateway associates the new i2004 Internet Telephone with the existing TN.

————— *End of Procedure* —————

## Remove an i2004 Internet Telephone from service

### Procedure 29

#### Taking an i2004 Internet telephone out of service

- 1      Disconnect the i2004 Internet Telephone from the network or turn the power off.
- 2      If the i2004 Internet Telephone was automatically configured, the DHCP lease will expire and the IP address returns to the available pool.
- 3      In Overlay 11, OUT the TN.

————— *End of Procedure* —————

## i2004 Internet Telephone maintenance and diagnostics

In the i2004 Internet Telephone, there are two kinds of TNs to consider:

- Physical TN, which represents a physical unit of the ITG card
- Virtual TN, which is configured on a virtual superloop and represents an i2004 Internet Telephone

Physical TNs, which are seen as card units, are managed using existing Overlay 32 commands.

Because virtual TNs are configured on virtual superloops, Virtual TN maintenance has no meaning. It is already provided by the Meridian 1 for phantom loops. In Overlay 32, any command affecting a phantom loop leads to an NTP665 message, since the loop does not physically exist. Overlay 32 supports STAT, DISU, ENLU and IDU commands on an i2004 Internet Telephone Virtual TN. All other commands lead to the new NPR047 message.

The IDU command provides the usual information, such as TN, TNID, NT code, color code, release code and serial number, as well as the IP address of the i2004 Internet Telephone and the IP address of the ITG card that is acting as the terminal proxy. The serial number is the last three bytes of the i2004 Internet Telephone's MAC address, printed in ASCII hex format.

Because Meridian 1 must request the information from the i2004 Internet Telephone, the IDU is effectively a "ping" command and can be used to test the end-to-end IP connectivity of the i2004 Internet Telephone. The output format of the IDU command in LD32 is shown in Table 26. This format only applies for i2004 Internet Telephone Virtual TNs.

If the i2004 Internet Telephone is not registered, an NPR0048 message is generated. If the i2004 Internet Telephone is registered but does not respond, the system prints the i2004 Internet Telephone IP address and ITG card IP address and generates an NPR0503 message.

**Table 26**  
**IDU command printout in LD32**

| Item        | Description     |
|-------------|-----------------|
| ISet TN:    | I s c u         |
| TN ID CODE: | I2004           |
| NT CODE:    | xxxxxx          |
| COLOR CODE: | xx              |
| RLS CODE:   | xx              |
| SER NUM:    | xxxxxxx         |
| SET IP ADR: | xxx.xxx.xxx.xxx |
| TPS IP ADR: | xxx.xxx.xxx.xxx |



**Table 27**  
**LD32 Available Maintenance Commands for the**  
**i2004 Internet Telephone**

| Prompt               | Response                                                                                                                                                                                      | Description                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| STAT lscu<br>STAT cu | UNEQ<br>IDLE REGISTERED<br>IDLE UNREGISTERED.<br>BUSY,<br>DSBL REGISTERED<br>DSBL UNREGISTERED                                                                                                | Display the i2004 state.<br>UNEQ, IDLE, BUSY and DSBL have the usual meaning.<br><br>IDLE and DSBL state are preceded by the following information:<br><ul style="list-style-type: none"> <li>• UNREGISTERED identifies an i2004 Internet Telephone that is configured in the system but that has not yet registered.</li> <li>• REGISTERED identifies an i2004 Internet Telephone that has registered.</li> </ul> |
| DISU lscu<br>DISU cu | OK                                                                                                                                                                                            | Change the i2004 Internet Telephone state to DSBL. UNREGISTERED/REGISTERED state is not modified.                                                                                                                                                                                                                                                                                                                  |
| ENLU lscu<br>ENLU cu | OK                                                                                                                                                                                            | Change the i2004 Internet Telephone state to IDLE. UNREGISTERED/REGISTERED state is not modified.                                                                                                                                                                                                                                                                                                                  |
| IDU lscu<br>IDU cu   | Displays the TN number, device code, NT code, color code, release code, last three bytes of MAC address. Displays the IP address for i2004 Internet Telephones and the Terminal Proxy Server. | Displays selected i2004 Internet Telephone information.                                                                                                                                                                                                                                                                                                                                                            |

## **Lamp audit and keep alive**

The Meridian 1 Lamp Audit function provides a continuous source of heartbeat messages to ensure the i2004 Internet Telephone is powered and the IP connection is alive. Since there is a reliable UDP connection from the Meridian 1 core through to the i2004 Internet Telephone, any failure of the i2004 Internet Telephone, the ITG card or the IP connection is detected.

You can run Network Signaling diagnostics as part of the midnight routines.

When the ITG card detects the i2004 Internet Telephone has been disconnected, the ITG card logs the event and sends an UNREGISTER message to the Meridian 1 for that i2004 Internet Telephone.

When the Meridian 1 CPU detects a loss of connection with the ITG card, Meridian 1 logs a message and UNREGISTERS all of the i2004 Internet Telephones and gateway channels associated with that ITG card.

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# ITG line card 2.0 administration

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Overview

This chapter explains how to administer the Meridian Internet Telephony Gateway (ITG) Line 2.0 card. The IP Line 2.0 card provides three administration interfaces:

- Meridian Administration Tools/Optivity Telephony Management (MAT/OTM)
  - Provides a graphical interface to the ITG Line 2.0 card. Use MAT/OTM to Telnet to the card, install and upgrade software, configure alarm event reporting, view and update card property and configuration data, add new cards to a node, schedule reports and other related tasks.
- Command Line Interface (CLI)
  - Use the CLI to display card and node status, change passwords, check software version, view channel states, and other card information. You can access the CLI through a direct serial connection to the I/O panel serial port, the Maint. Port on the faceplate, or through a Telnet session. Use a VT-100 terminal emulation program set to 9600 baud, 8 bits, no parity, one stop bit.
- Meridian 1 Overlays
  - Use the same commands and messages for the ITG Line 2.0 card as you use for the digital line (XDLC) card. This chapter explains how to use LD 32 for card maintenance.

## MAT/OTM OA&M administration procedures

This section describes the MAT/OTM administration procedures you can perform using the MAT/OTM **ITG IP Phones** application. All of the references to MAT/OTM in the following procedures assume the latest MAT/OTM version: MAT6.60.07 (with update disk)/OTM 1.0.

**Note:** To obtain the latest software versions information and files, refer to the M1 ESD website at URL:

“<http://www.nortelnetworks.com/servsup/esd/meridian1/>”.

### ITG operational measurement (OM) report scheduling and generation

Operational Measurement (OM) reports provide important statistical and traffic information and feedback to the system administrator to better engineer the system. The information stored in the OM file applies only to the calls routed over the IP network by way of ITG. OM reports give a quantitative view of system performance.

The OM reports are a collection of data from all the ITG Line 2.0 cards in the network. OM data is written to a file every hour. At midnight, the OM file is copied to a backup file, and the new day starts with a new file.

MAT/OTM uses the following naming convention for the OM file names:

itgIPPHONE\_3\_2000\_file1

The user generates OM reports on demand or on a pre-selected schedule. When a report is generated, the application retrieves the latest OM data from each ITG Line 2.0 card defined in MAT/OTM.

**Note:** Nortel Networks recommends that you schedule report generation once a day.

**Procedure 30**  
**Report scheduling**

- 1 In the ITG Main window, click **File | Report | Generate**.
- 2 In the **ITG - Generate Report** window, select the **Schedule report generation** radio button.
- 3 Click **OK**. The Scheduling window appears (see Figure 27).
- 4 In the “Job” text box, enter the name and description of the schedule.
- 5 In the “Run” box, click the radio button that indicates the frequency of report generation
- 6 In the “Start at” box, enter the month, day, year, hour, and minute of the start of the report period. Select the “am” or “pm” radio button.
- 7 Click **Apply** and **OK**

----- *End of Procedure* -----.

**Figure 27**  
**Scheduling window**

**Scheduling**

Job

Name :

Description :

Run

☒ None ☐ Delete When Done

☐ Once

☐ Hourly

☐ Daily

☐ Weekdays

☐ Weekly

☐ Monthly

☐ Month-end

☐ Custom

Start at

Month Day Year

3 27 2000

Hour Minute

2 33

☐ am ☒ pm

☐ Late execution

**Procedure 31**  
**Report generation**

- 1 In the **IP Telephony Gateway- IP Phones** window, click **File | Report | Generate**.
- 2 In the **ITG - Generate Report** window, click **Generate OM Report now**.
- 3 Click **OK**.  
  
MAT/OTM creates and displays a report named "ITG IP Phones - Operational Measurement Report." The default display is Microsoft Excel.™

————— *End of Procedure* —————

**Procedure 32**  
**Open an Operational Measurement (OM) report**

- 1 In the "IP Telephony Gateway - IP Phones" window, click **File | Report | Open**. The Open OM Report window opens (see Figure 28).
- 2 Select a report file and click **Open**. The file opens in a program that interprets.csv (comma-delimited) files such as Microsoft Excel.™

————— *End of Procedure* —————

## **View ITG info and error log**

MAT/OTM uses FTP to transfer the file from the ITG Line 2.0 card to the PC and open in the WordPad application. The ITG Error log file displays error information, including error date/time, the originating module (ITG node), and specific error data.

### Procedure 33

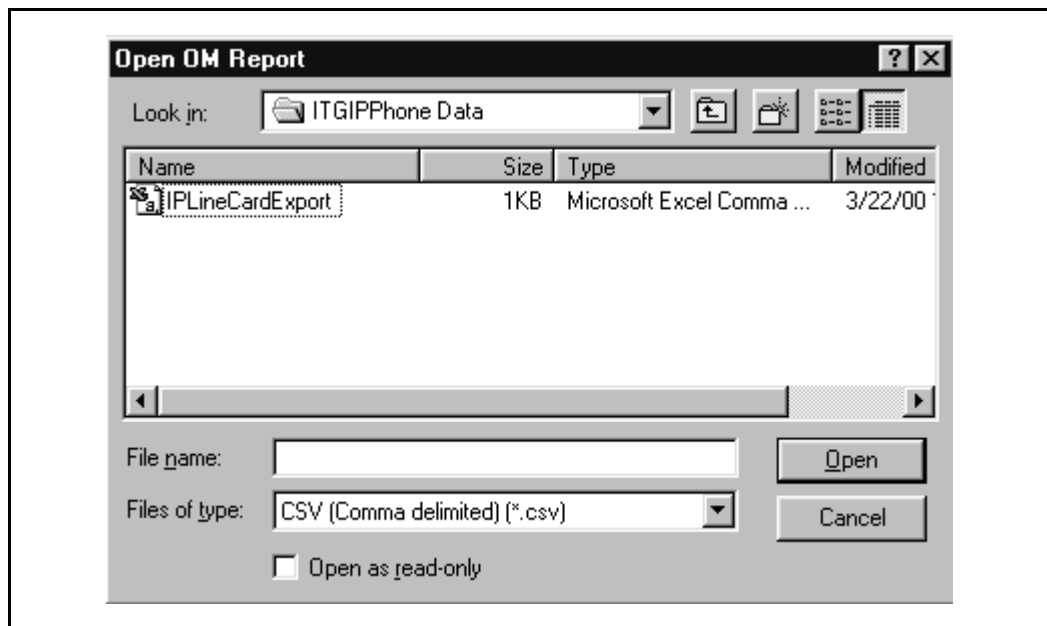
#### Viewing ITG info and error log

To view ITG error conditions that are abnormal events, but not severe enough to raise an alarm:

- 1 In the “MAT/OTM Navigator” window, select the **ITG IP Phones** icon from the “Services” folder.
- 2 In the “IP Telephony Gateway - IP Phones” window, click the right mouse button and select **Card | Properties** from the pop-up menu.
- 3 Click the **Open log file** button and review the file contents.

————— *End of Procedure* —————

**Figure 28**  
**Open OM Report**





## Configure SNMP traps

### Procedure 34

#### Configuring SNMP Traps

- 1 Return to the "MAT/OTM Navigator" window.
- 2 In the MAT/OTM Navigator window select **Utilities | Alarm Notification**. The "MAT/OTM Alarm Notification" dialog box appears (Figure 29).
- 3 Select **Configuration | Run Options**.  
The "Alarm Notification Run Options" dialog box appears.
- 4 Click the **Control Files** tab.
- 5 Click **Devices | Browse**. The "Open" dialog box appears.
- 6 Select the "Devices.txt" file from the "Control Files" folder and click **Open**. The "Devices.txt" file opens.
- 7 For each ITG Line 2.0 card in each monitored ITG Line 2.0 card node, add a line consisting of three fields separated by spaces, as shown in Table 28. Enter the first line under the last line that begins with a "#".
- 8 Click **File|Save**.
- 9 In the "Alarm Notification Run Options" window, click **Apply** then **OK**.  
**Note:** MAT/OTM Alarm Notification must be restarted whenever Control Files are changed.
- 10 If MAT/OTM Alarm Notification is running (i.e., the red traffic light is showing on the tool bar), first stop it by clicking on the red traffic light on the tool bar. Restart it by clicking on the green traffic light.
- 11 If MAT/OTM Alarm Notification is not running (i.e., green traffic light showing on the tool bar), start it by clicking on the green traffic light to change it to red.
- 12 Enter the **trap\_gen** command from the ITG shell. A series of SNMP traps is emitted by the ITG Line 2.0 card and appears in the MAT/OTM Alarm Notification browser window. Verify the device name identifies the correct ITG Line 2.0 card.

————— *End of Procedure* —————

**Figure 29**  
**Alarm Notification Run Options (General tab)**

The screenshot shows a dialog box titled "Alarm Notification Run Options" with a close button (X) in the top right corner. The dialog has three tabs: "General", "Control Files", and "Notification". The "General" tab is selected.

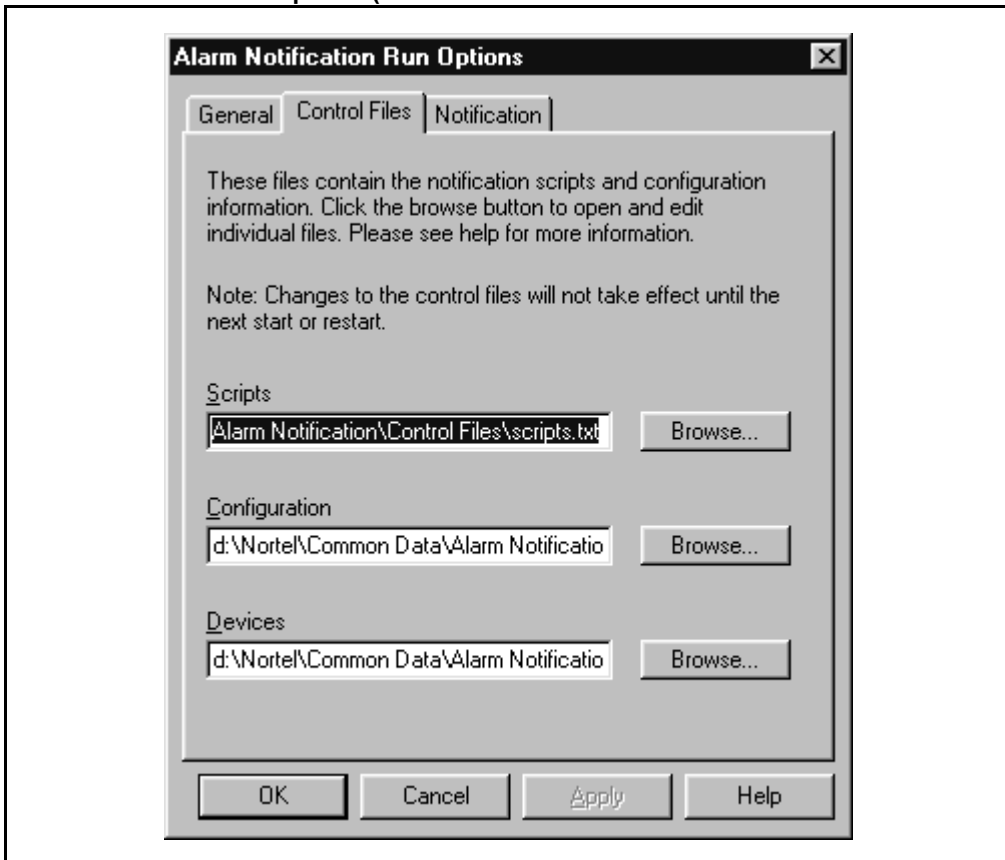
Inside the "General" tab, there is a checkbox labeled "Auto-start scripts on program launch" which is currently unchecked.

Below this, there are two sections:

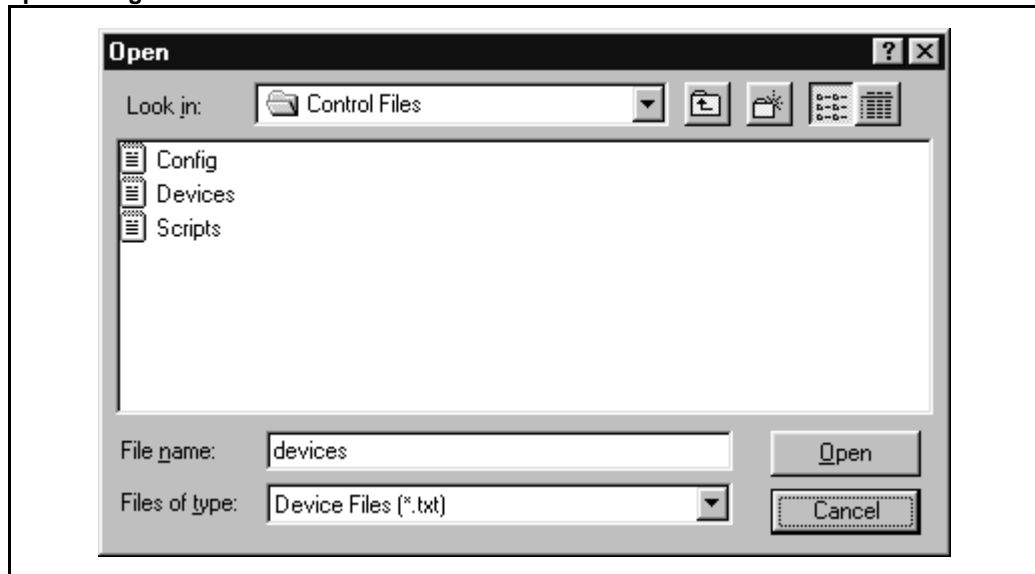
- Windows Event Browser:**
  - Maximum number of events: 500 (range 500-5000)
  - Maximum console entries: 5000 (range 500-5000)
- Web Event Browser:**
  - ☒ Start event web server when scripts are run
  - Web site name: [empty text box]
  - Maximum number of events: 5000 (range 500-5000)
  - Maximum console entries: 5000 (range 500-5000)
  - Network port number: 80
  - Web refresh rate: 30 seconds

At the bottom of the dialog, there are four buttons: "OK", "Cancel", "Apply", and "Help".

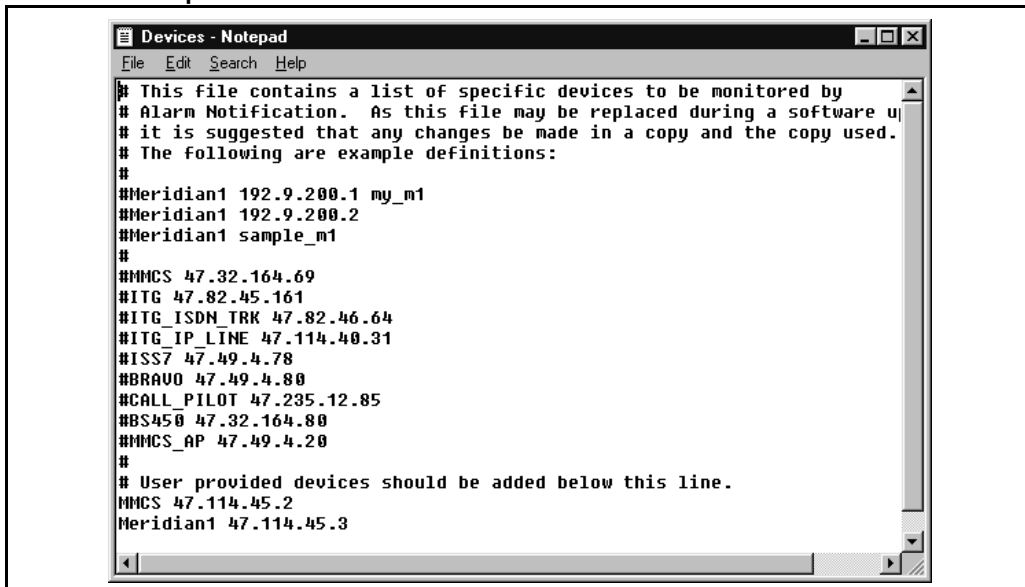
**Figure 30**  
**Alarm Notification Run Options (Control Files tab)**



**Figure 31**  
**Open dialog box**



**Figure 32**  
**Devices.txt Notepad**



**Table 28**  
**Format of Devices.txt file**

| Device Type   | IP Address      | Device Name     |
|---------------|-----------------|-----------------|
| ITG_IP_PHONES | xxx.xxx.xxx.xxx | Site_Leader_0   |
| ITG_IP_PHONES | xxx.xxx.xxx.xxx | Site_Leader_1   |
| ITG_IP_PHONES | xxx.xxx.xxx.xxx | Site_Follower_2 |

## Back up and restore MAT/OTM data

The MAT/OTM Backup Wizard is used to backup and restore any or all of MAT/OTM PC based data, including ITG MAT/OTM data. All of the ITG data is stored in an Access database file on the MAT/OTM PC or Server. This file is only backed up when the user selects the “Disaster Recovery” option. This option backs up all MAT/OTM data and can only be used to restore all data.

For more information on using the MAT/OTM Backup Wizard, see the *Common Services User Guide* in the *MAT/OTM User Guides*.

## Update ITG node properties

### Procedure 35

#### Updating the ITG node properties:

- 1 In the MAT/OTM Navigator window, select the **ITG IP Phones** icon from the “Services” folder. The system displays the “**IP Telephony Gateway - IP Phones**” screen.
- 2 Click the right mouse button on a card and select **Node | Properties** from the pop-up menu.
- 3 Perform all required updates to the ITG Node “General” tab parameters.
- 4 If you add or delete ITG Line 2.0 cards from the node or change an ITG Line 2.0 card (refer to the Maintenance section for the procedure to replace an ITG Line 2.0 card), then use one of the following procedures:
  - “Delete an ITG Line 2.0 card from the node” on page 191
  - “Change an IP address” on page 191

————— *End of Procedure* —————

## Add an ITG Line 2.0 card to the node

### Procedure 36

#### Adding an ITG line card to the node

Refer to “Installation and configuration of ITG Line 2.0 node” on page 111 and Procedure b on page 128, to add a card to a node.

## Delete an ITG Line 2.0 card from the node

### Procedure 37

#### Deleting an ITG Line card from the node

- 1 In the “MAT/OTM Navigator” window select the **ITG IP Phones** icon from the “Services” folder.
- 2 If the ITG Line 2.0 card to be deleted is a Leader 0 or Leader 1, then:
  - Telnet to the card.
  - Enter the **clearLeader** command from the ITG shell.
- 3 In the “IP Telephony Gateway - IP Phones” window, select **Node | Properties** from the popup menu. The ITG Node Properties window is displayed.
- 4 Click the “Configuration” tab.
- 5 Select the ITG Line 2.0 card to be deleted from the list.
- 6 Click the **Delete** button.
- 7 Click **OK**.
- 8 Remove the ITG Line 2.0 cards via the MAT/OTM System Passthru terminal, ESN MAT/OTM application, or via a Meridian 1 system management terminal directly connected to a TTY port on the Meridian 1. Use Overlay 11.

————— *End of Procedure* —————

## Change an IP address

### Procedure 38

#### Changing the IP address of an ITG line card

- 1 Click **Configuration | Node | Properties**. Update the ITG Line 2.0 card IP addresses as required.
- 2 When all updates to the IP addresses have been made, click **Apply** then **OK** in the “ITG Node Properties” window.

The node properties are transmitted to the Leader 0 card:
- 3 Select the Leader 0 ITG Line 2.0 card in the IP Telephony Gateway - IP Phones window.
- 4 Click the **Configuration** menu, then **Synchronize**, then **Transmit**.

- 5 Click the “Transmit to selected nodes” radio button.
- 6 Click the “Node Properties” check box.
- 7 Click the **Start Download** button.  
The results of the download appear in the “Transmit control” box.
- 8 Click **Close**.
- 9 If you have changed the IP addresses of any cards, restart the cards for the changes to take effect.

————— *End of Procedure* —————

## Update ITG Line 2.0 card properties

**Note:** Some basic ITG Line 2.0 card configuration, including IP address configuration, must be performed from the ITG Node Properties window, as described in “Update ITG node properties” on page 190.

### Procedure 39 Updating card properties

- 1 In the “MAT/OTM Navigator” window, select the **ITG IP Phones** icon from the “Services” folder.
- 2 In the “IP Telephony Gateway - IP Phones” window, select the ITG Line 2.0 card to be modified.
- 3 Select the ITG Line 2.0 card to be updated and click the right mouse button to select **Cards | Properties** from the pop-up menu. The “ITG Line 2.0 card Properties” window appears. The “Configuration, SNMP traps, and Security” tabs are described following step 3.
- 4 Make the required changes to the ITG Line 2.0 card configuration.
- 5 Click **Apply** then **OK**.

————— *End of Procedure* —————



## Use the Retrieve command

The Retrieve command sends information from the ITG Line 2.0 cards to the MAT /OTM ITG node. The Retrieve command is used for:

- a remote MAT/OTM user to download a node or card configuration  
*Note:* This can also be performed by doing the “Add ITG Node” command and selecting the “Retrieve the active configuration from an existing node” option.
- for copying node information from one node to another
- for restoring accidentally changed MAT/OTM information, and
- for downloading information to a fictitious “dummy” node that has been created for this purpose, in order to view the configuration of the ITG Line 2.0 cards and node.

### Procedure 40

#### Using the Retrieve command:

- 1 In the “IP Telephony Gateway- IP Phones” window, select the card(s) from which to retrieve information.
- 2 Click **Configuration | Synchronize | Retrieve**.
- 3 Configure whether to retrieve “Node properties” or “Card properties.” Click one or more of the check boxes.
- 4 Click **Start Retrieve**. The results of the Retrieve command are displayed in the “Retrieve control” box.

————— *End of Procedure* —————

## Add an ITG node on MAT /OTM by retrieving an existing node

Use this optional procedure in the following cases:

- Add existing nodes to a particular MAT/OTM ITG PC to manage the ITG network from a single point of view.
- Restore the ITG configuration database to a MAT/OTM ITG PC whose hard drive had crashed, as an alternative to restoring the MAT/OTM ITG nodes from the MAT/OTM Disaster Recovery Backup.

When you install and configure the ITG node manually, you can then add that node to another MAT/OTM ITG PC by retrieving the configuration data from the existing ITG node.

Make sure that you configure the site name, system name, and customer number in the MAT/OTM Navigator before you can add a new ITG node. Only one ITG node can be added in the MAT/OTM ITG application for each Meridian 1 customer.

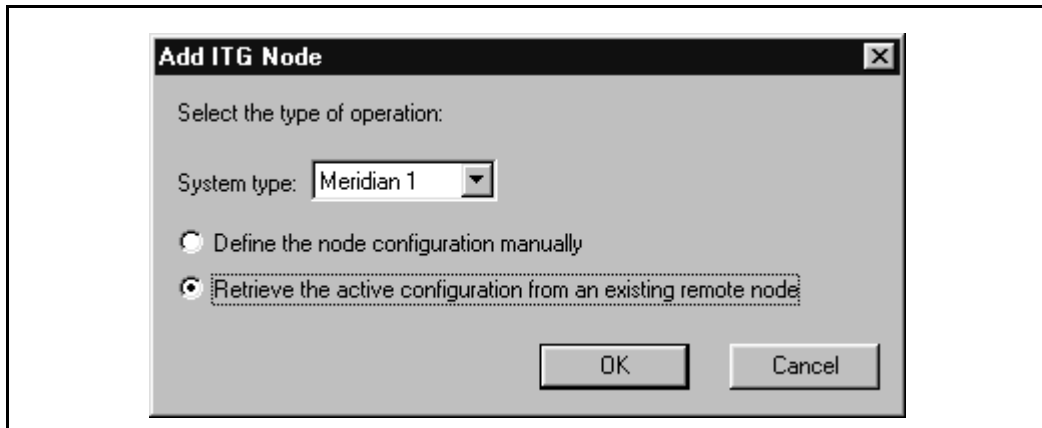
**Note:** If multiple MAT/OTM ITG PCs are used to manage the same ITG network, care must be taken to synchronize the different copies of the ITG database. The MAT/OTM ITG

**Configuration | Synchronize | Retrieve** function can be used to synchronize the MAT/OTM ITG database with the database on the ITG node.

### Procedure 41 Configuring the node and Leader 0

- 1 Launch the Meridian Administration Tools application on the MAT/OTM PC.
- 2 From the “MAT/OTM Navigator” window, double-click the **ITG IP Phones** icon from the “Services” folder. The “IP Telephony Gateway - IP Phone” window opens.
- 3 In the “IP Telephony Gateway - IP phone” window, click the **Configuration** menu and select **Node**, then **Add**.
- 4 When the Add ITG Node dialog box (see Figure 33) appears, click “Retrieve the active configuration from an existing remote node” and click **OK**. The **Retrieve ITG Node** window opens (see Figure 34).

**Figure 33**  
**Add ITG Node dialog box**



- 5 In the “Retrieve ITG node” window, select the “MAT/OTM Site”, and “Meridian 1 System” fields. Select the “Meridian 1 Customer” number.

**Note:** The site name, Meridian 1 system name, and Meridian 1 customer number must exist in the MAT/OTM Navigator before you can add a new ITG node. Only one ITG node can be added in the MAT/OTM ITG application per Meridian 1 customer.

- 6 Enter the active leader management IP address field for the existing node.
- 7 Enter the SNMP read/write community name. The default is “private”.
- 8 Click **Start Retrieve**.  
  
The results of the retrieval are shown in the “Retrieve control” dialog box. The node properties are retrieved from the active leader. The card properties are retrieved from Leader 0.
- 9 Click **Close** when the download is complete.
- 10 Refresh the card status from the View menu, and verify that the cards in the newly added node are responding.

**Figure 34**  
**Retrieve ITG node**

**Retrieve ITG node** [X]

To retrieve an existing ITG node, define the node location and click Start retrieve button. This will retrieve the Node properties, Dialing plan, and Card properties from the leader card. To retrieve the other card properties, use the retrieve menu option

This operation requires an established connection to the management LAN of the ITG node.

**Node Location**

MAT site: Sample Site

MAT system: Sample System

Customer: 0

Node Number: 0

Active leader management IP: . . .

SNMP community read/write name:

**Retrieve control**

Start retrieve Cancel retrieve View last retrieve

Close Help

- 11 In the main window, select Leader 0 of the newly added node.
- 12 Use the **Configuration|Synchronize|Retrieve** command to retrieve the card properties for all ITG Line 2.0 cards in the selected node.

————— *End of Procedure* —————

## ITG shell command-line interface access via Telnet or maintenance port

There are two ways to access the Command Line Interface (CLI):

- 1 Use the NTAG81CA (or NTAG81BA) cable to connect the faceplate or I/O cable serial port to a TTY or PC Com port.
- 2 Telnet to the card. You can Telnet to the card from the MAT/OTM IP Telephony Gateway - IP Phones Main Window or use the Telnet application on your computer.

### CAUTION

Do not connect two maintenance terminals to both the faceplate and I/O panel serial maintenance port connections at the same time.

## Telnet to an ITG Line 2.0 card

To access the command line on an ITG Line 2.0 card from the MAT/OTM PC perform Procedure 42 on page 197.

### Procedure 42

#### Telnet to an ITG Line 2.0 card

- 1 In the "MAT/OTM Navigator" window select the **ITG IP Phones** icon from the "Services" folder.
- 2 In the "IP Telephony Gateway - IP Phones" window click the right mouse button on the ITG Line 2.0 card that you wish to access and select **Card | Telnet to IP Telephony Gateway Line 2.0 card** from the popup menu.
- 3 The default user name and password are **itgadmin**.

- 4 The MAT/OTM PC opens a Telnet window and automatically connects to the ITG Line 2.0 card by using the management IP address. Enter a username and password to access the ITG shell command-line interface.

————— *End of Procedure* —————

## Telnet and FTP security information

Good security policy requires changing user names and passwords periodically. The ITG user name and password protects FTP and Telnet access to the ITG Line 2.0 card over the LAN.

### Procedure 43

#### Changing the username and password

- 1 From the ITG shell use the command **shellPasswordSet** to change the default user name and password for Telnet to ITG shell and FTP to the ITG Line 2.0 card file system.

The default user name is **itgadmin** and the default password is **itgadmin**.

- 2 You will be prompted as follows:

Enter current username: itgadmin  
Enter current password: itgadmin  
Enter new username: newname  
Enter new password: newpwd  
Enter new password again to confirm: newpwd

If the entire sequence of commands is successfully entered, you get the system response with 'value = 0 = 0x0'. The new user name and password are now stored in the non-volatile RAM on the ITG Line 2.0 card, and will be retained even if the card is reset, powered-off, or on.

————— *End of Procedure* —————

## Download the ITG operational measurements through the ITG shell

The ITG Line 2.0 card operational measurements file contains counts of incoming and outgoing calls, call attempts, calls completed, and total holding time for voice calls. To download this file from the MAT/OTM PC to the ITG Line 2.0 card perform

**Procedure 44****Downloading ITG data from the MAT PC**

- 1 At the ITG shell prompt, type: **currOMFilePut** *<hostname, username, password, directory path, filename>* for the current file, or **prevOMFilePut** *<hostname, username, password, directory path, filename>* for the previous file.
- 2 At the ITG shell prompt, type: **currGKOMFilePut** *<hostname, username, password, directory path, filename>* for the current file, or **prevGKOMFilePut** *<hostname, username, password, directory path, filename>* for the previous file.

————— *End of Procedure* —————

**Reset the operational measurements**

This command resets all operational measurement (OM) parameters that have been collected since the last log dump.

At the ITG shell prompt, type: **resetOM**.

**Display the number of DSPs**

This command displays the number of DSPs on the ITG Line 2.0 card.

At the ITG shell prompt, type: **DSPNumShow**

**Display ITG Node Properties**

This command displays information about an ITG node.

At the ITG shell prompt, type: **IPInfoShow**

The following ITG node information is displayed on the TTY:

- IP addresses for the management and voice subnets
- default router for the management and voice subnets
- subnet mask for the management and voice subnets
- SNMP manager

## Display ITG card properties

To display information about an ITG Line 2.0 card, enter the following command: **itgCardShow**

The following commands give additional information about an ITG Line 2.0 card:

- ifShow
- serialNumShow
- firmwareVersionShow
- swVersionShow

## Transfer files using the command-line interface

To transfer a file from the ITG Line 2.0 card to the MAT/OTM PC or from the MAT/OTM PC to the ITG Line 2.0 card, enter one of the ITG line commands at the ITG shell command-line, depending on what type of file transfer is to occur.

These commands are from the perspective of the ITG Line 2.0 card: that is, commands containing “Get” as part of the command refer to file transfer from the MAT/OTM PC to the ITG Line 2.0 card, while commands containing “Put” as part of the command refer to file transfer from the ITG Line 2.0 card to the MAT/OTM PC:

**Note 1:** These commands are *case-sensitive*. The parameters following the command must each be enclosed in quotes, and there must be a comma and no spaces between the parameters.

**Note 2:** Refer to “ITG Line card 2.0 maintenance” on page 205 for a complete description of the various ITG shell file transfer commands.

**Note 3:** *Hostname* refers to the either IP address of the FTP host, or the ITG Line 2.0 card itself or another ITG Line 2.0 card when a PC card in the A: drive or C: drive (the swDownload command must only use the A: drive), of the ITG Line 2.0 card contains the software binary file.



The following commands can be entered at the ITG shell command-line:

**Table 3**  
**ITGL Shell Commands**

**Shell commands**

```
swDownload <hostname> <username> <password> <directory path> <filename>
configFileGet <hostname> <username> <password> <directory path> <filename>
bootPFileGet <hostname> <username> <password> <directory path> <filename>
bootPFilePut <hostname> <username> <password> <directory path> <filename>
hostFileGet <hostname> <username> <password> <directory path> <filename>
<ITGFileName> <listener>
currOmFilePut <hostname> <username> <password> <directory path> <filename>
prevOmFilePut <hostname> <username> <password> <directory path> <filename>
traceFilePut <hostname> <username> <password> <directory path> <filename>
currLogFilePut <hostname> <username> <password> <directory path> <filename>
prevLogFilePut <hostname> <username> <password> <directory path> <filename>
configFilePut <hostname> <username> <password> <directory path> <filename>
hostFilePut <hostname> <username> <password> <directory path> <filename>
<ITGFileName>
```

## IP configuration commands

**Table 4**  
**IP configuration commands**

| IP configuration command | Function                                                                                                                                    |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| setLeader                | Performs all the necessary actions to make a leader. Sets IP address, gateway, subnet mask, boot method to static, and leader bit in NVRAM. |
| clearLeader              | Clears the leader info in NVRAM and sets the boot method to use bootp, thus, making the card a follower:                                    |
| NVRIPShow                | Prints the values of the IP parameters that reside in NVRAM.                                                                                |

## Download the ITG error log

The ITG error log contains error conditions as well as normal events. Some of the error conditions cab be severe enough to raise an alarm through SNMP traps.

The following commands are used to download an ITG error log:

- currLogFilePut
- prevLogFilePut

## Lamp audit and keep alive

The Meridian 1 Lamp Audit function provides a continuous source of heartbeat messages to ensure the i2004 Internet Telephone is powered and the IP connection is alive. Since there is a reliable UDP connection from the Meridian 1 core through to the i2004 Internet Telephone, any failure of the i2004 Internet Telephone, the ITG card or the IP connection is detected.

You can run Network Signaling diagnostics as part of the midnight routines.

When the ITG card detects the i2004 Internet Telephone has been disconnected, the ITG card logs the event and sends an UNREGISTER message to the Meridian 1 for that i2004 Internet Telephone. When the Meridian 1 CPU detects a loss of connection with the ITG card, Meridian 1 logs a message and UNREGISTERS all of the i2004 Internet Telephones and gateway channels associated with that ITG card. Table 29 summarizes the Meridian 1 system administration commands available in overlay 32.

**Table 29**  
**LD 32 - Administration commands for the ITG Line 2.0 card**

| Command      | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DISC l s c   | <p>Disable the specified card,<br/>where: l = loop, s = shelf, c = card.</p> <p><b>Note 1:</b> You must disable the ITG Line 2.0 card before you transmit card properties from the MAT/OTM ITG IP Phones application.</p> <p><b>Note 2:</b> The card reset button is only available in the MAT/OTM ITG application when the card is disabled.</p> <p><b>Note 3:</b> When you disable the ITG Line 2.0 card in LD 32 it does not disable the active leader or backup leader functions.</p> |
| DISI l s c   | <p>Disable the specified card when idle, where: l = loop, s = shelf,<br/>c = card</p> <p><b>Note 1:</b> This will temporarily prevent the ITG node from seizing the port from incoming calls.</p> <p><b>Note 2:</b> You should use the DISI command to disable the ITG Line 2.0 card instead of the DISC command. The disabled state of the ITG Line 2.0 card is indicated by the NPR0011 message.</p>                                                                                    |
| DISU l s c u | <p>Disable the specified unit,<br/>where: l = loop, s = shelf,<br/>c = card, u = unit</p>                                                                                                                                                                                                                                                                                                                                                                                                 |
| ENLC l s c   | <p>Enable the specified card,<br/>where: l = loop, s = shelf,<br/>c = card</p>                                                                                                                                                                                                                                                                                                                                                                                                            |
| ENLU l s c u | <p>Enable the specified unit,<br/>where: l = loop, s = shelf,<br/>c = card, u = unit</p>                                                                                                                                                                                                                                                                                                                                                                                                  |

**Table 29**  
**LD 32 - Administration commands for the ITG Line 2.0 card**

| Command      | Function                                                                                                                                                                                                                               |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IDC l s c    | Print the Card ID information for the specified card, where: l = loop, s = shelf, c = card<br><br><b>Note 1:</b> This command will display the PEC (Product Engineering Code) and serial number for the card. The ITG PEC is NTZC80AA. |
| STAT l s c   | Print the Meridian 1 software status of the specified card.<br>where: l = loop, s = shelf, c = card                                                                                                                                    |
| STAT l s c u | Print the Meridian 1 software status of the specified unit, where: l = loop, s = shelf, c = card, u = unit                                                                                                                             |

---

# ITG Line card 2.0 maintenance

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## Contents

This section contains information on the following topics:

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## Overview

This section provides information on maintenance functions of the Meridian Internet Telephony Gateway (ITG) Line 2.0 card. Where reference is made to MAT/OTM, the latest version, MAT 6.67.07/OTM 1.0 (or later), is assumed.

**Note:** Check the M1 ESD website for information on the latest software, firmware and application releases. Refer to Procedure 20 on page 152 to guide you through the website.

## Faceplate maintenance display codes

The ITG Line 2.0 card maintenance display provides the diagnostic status of the card during power-up, its operational state when in service, and error information on the functional state of the card. Table 30, “Faceplate maintenance display codes,” on page 207 lists the normal and fault codes.

During power-up, the card performs multiple self-tests, including an internal RAM test, ALU test, address mode test, Boot ROM test, timer test, and external RAM test. If any of these tests fail, the card will enter a maintenance loop, and no further processing will be possible. A failure message is printed on the display to indicate which test failed. For example, if the timer test fails, “F:05” is displayed.

If any of the other tests fail (up to and including the EEPROM test), a message is displayed for three seconds. If more than one test fails, the message displayed will indicate the first failure. If verbose mode has been selected (by the test input pin on the backplane), the three second failure message is not displayed.

If the maintenance display shows a persistent T:20 indicating an ITG software failure and if this occurs after the card was reset during a software download procedure, call your Nortel Networks technical support for assistance in attempting to download new software onto the card

**Table 30**  
**Faceplate maintenance display codes**

| <b>Normal code</b> | <b>Fault code</b> | <b>Message</b>                                                     |
|--------------------|-------------------|--------------------------------------------------------------------|
| T:00               | F:00              | Initialization                                                     |
| T:01               | F:01              | Testing Internal RAM                                               |
| T:02               | F:02              | Testing ALU                                                        |
| T:03               | F:03              | Testing address mode                                               |
| T:04               | F:04              | Testing Boot ROM                                                   |
| T:05               | F:05              | Testing timers                                                     |
| T:06               | F:06              | Testing watchdog                                                   |
| T:07               | F:07              | Testing external RAM                                               |
| T:08               | F:08              | Testing Host DPRAM                                                 |
| T:09               | F:09              | Testing DS30 DPRAM                                                 |
| T:10               | F:10              | Testing Security Device                                            |
| T:11               | F:11              | Testing Flash memory                                               |
| T:12               | F:12              | Programming PCI FPGA                                               |
| T:13               | F:13              | Programming DS30 FPGA                                              |
| T:14               | F:14              | Programming CEMUX FPGA                                             |
| T:15               | F:15              | Programming DSP FPGA                                               |
| T:16               | F:16              | Testing CEMUX interface                                            |
| T:17               | F:17              | Testing EEPROM                                                     |
| T:18               | F:18              | Booting processor, waiting for response with self-test information |
| T:19               | F:19              | Waiting for application start-up messages from processor.          |

**Table 30**  
**Faceplate maintenance display codes**

|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| T:20 | <p>CardLAN enabled, transmitting bootp requests.</p> <p>If this display persists, then the ITG 2.0 card is running in BIOS ROM mode due to card software failure.</p>                                                                                                                                                                                                                                                                                                                                                                                                                         |
| T:21 | <p>CardLAN operational, A07 enabled , display now under host control.</p> <p>Card is looking for an active leader by sending bootp requests on the management LAN. If no bootp response is received on the management LAN, Leader 0 times out first and starts active leader tasks. Leader 1 has a longer time out and normally starts backup leader, otherwise Leader 1 times out and starts active leader tasks.</p> <p>A follower card sends bootp requests on the management LAN continuously and never times out. Enter “+++” to escape from bootp request mode and start ITG shell.</p> |
| T:22 | <p>The ITG Line 2.0 card is attempting to start the application.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Lxxx | <p>Card is running active leader tasks, where xxx = number of i2004 Internet Telephones registered on the card</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Fxxx | <p>Card has detected the active leader, and is running Follower tasks, where xxx = number of i2004 Internet Telephones registered on the card</p>                                                                                                                                                                                                                                                                                                                                                                                                                                             |



## System error messages

When an error or specific event occurs, SNMP sends an alarm trap to MAT/OTM or any SNMP manager that is configured in the SNMP Manager's list in the ITG Line 2.0 card properties. It also puts the system error message into the error log file containing error messages.

You can view the error log in MAT/OTM ITG by clicking on the 'Open Log File' button on the "Maintenance" tab of the ITG Line 2.0 card properties. You can also view the log file in any text browser after uploading it to an FTP host using the **currLogFilePut** or **prevLogFilePut**.

Error messages with a severity category of "Critical", are displayed on the ITG maintenance face plate in the form: "**Gxxx**", or "**Sxxx**", where "**xxx**" is the last three digits of the ITG or ITS message. Table 31 on page 209 lists the critical ITG and ITS messages.

**Table 31**  
**Critical ITG and ITS Error messages**

| Maintenance Display | Corresponding Circuital Error Message | Description                                                 |
|---------------------|---------------------------------------|-------------------------------------------------------------|
| G000                | ITG1000                               | Card (re)booted,                                            |
| G001                | ITG1001                               | Task spawn failure <name>.                                  |
| G002                | ITG1002                               | Memory allocation failure.                                  |
| G003                | ITG1003                               | File IO error <operation> <object> <errno> <errtext>.       |
| G004                | ITG1004                               | Network IO error <operation> <object> <errno> <errtext>.    |
| G005                | ITG1005                               | Message queue error <operation> <object> <errno> <errtext>. |
| G006                | ITG1006                               | Unexpected state encountered <file> <line> <state>.         |
| G007                | ITS1007                               | Unexpected message type <file> <line> <msg>.                |

**Table 31**  
**Critical ITG and ITS Error messages**

| Maintenance Display | Corresponding Circuital Error Message | Description                                                           |
|---------------------|---------------------------------------|-----------------------------------------------------------------------|
| G008                | ITG1008                               | Null pointer encountered <file> <line><br>Name of pointer.            |
| G009                | ITG1009                               | Invalid block <file> <line> Type of block.                            |
| G010                | ITG1010                               | Unable to locate data block <file><br><line> Type of block.           |
| G011                | ITG1011                               | Failed to push file <file> <host>.                                    |
| G012                | ITG1012                               | Failed to retrieve file <file> <host>.                                |
| G013                | ITG1013                               | Voice ethernet receive buffer unavailable, packet(s) discarded.       |
| G014                | ITG1014                               | Management ethernet receive buffer unavailable, packet(s), discarded. |
| G015                | ITG1015                               | Voice ethernet device failure.                                        |
| G016                | ITG1016                               | Management ethernet device failure.                                   |
| G017                | ITG1017                               | Invalid or unknown A07 SSD message<br><tn> <msg>.                     |
| G018                | ITG1018                               | Invalid or unknown X12 SSD message<br><tn> <msg>.                     |
| G019                | ITG1019                               | DSP channel open failure <channel>.                                   |
| G020                | ITG1020                               | Configuration error <param> <value><br><reason>.                      |
| G021                | ITG1021                               | DSP successfully reset <dsp>.                                         |
| G022                | ITG1022                               | DSP channel not responding, channel disabled <channel>.               |
| G023                | ITG1023                               | DSP device failure, operating at reduced capacity <dsp>.              |

**Table 31**  
**Critical ITG and ITS Error messages**

| Maintenance Display | Corresponding Circuital Error Message | Description                                                       |
|---------------------|---------------------------------------|-------------------------------------------------------------------|
| G024                | ITG1024                               | DSP failure <dsp> <errno> <errtext>.                              |
| G025                | ITG1025                               | DSP download failed retrying <dsp>.                               |
| G026                | ITG1026                               | DSP download retry succeeded <dsp>.                               |
| G027                | ITG1027                               | DSP memory test timed out <dsp>.                                  |
| G028                | ITG1028                               | DSP memory test failed <dsp>.                                     |
| G029                | ITG1029                               | Error in DSP task <file> <line> <errno> <errtext>.                |
| G030                | ITG1030                               | Channel registration failure <channel> <errno> <errtext>.         |
| G031                | ITG1031                               | Allocation failure in DSP memory pool.                            |
| G032                | ITG1032                               | Invalid codec number <codec>.                                     |
| G033                | ITG1033                               | Duplicate open attempt on channel <channel>.                      |
| G034                | ITG1034                               | DSP channel send failure <channel>.                               |
| G035                | ITG1035                               | Channel unexpectedly closed <channel>.                            |
| G036                | ITG1036                               | Encountered unexpected open channel, closed it <channel>.         |
| S000                | ITS1000                               | VTI function call timeout.                                        |
| S001                | ITS1001                               | User terminal registration failed. <ip> <hwid> <errno> <errtext>. |
| S002                | ITS1002                               | Connect service activation error <reason>.                        |
| S003                | ITS1003                               | Duplicate master <node> <ip1> <ip2>.                              |

**Table 31**  
**Critical ITG and ITS Error messages**

| Maintenance Display | Corresponding Circuitual Error Message | Description                                        |
|---------------------|----------------------------------------|----------------------------------------------------|
| S004                | ITS1004                                | Failed to retrieve node ID and TN <ip> <hwid>      |
| S005                | ITS1005                                | Invalid node ID <ip> <hwid>.                       |
| S006                | ITS1006                                | Corrupted node ID/TN field <ip> <hwid>.            |
| S007                | ITS1007                                | Received corrupted UNISlim message <message dump>. |
| S008                | ITS1008                                | Received unknown UNISlim message <message dump>.   |
| S009                | ITS1009                                | RUDP connection lost: <ip>.                        |
| S010                | ITS1010                                | RUDP connection restarted: <ip>.                   |
| S011                | ITS1011                                | Communication link to M1 is down.                  |

## Replacing an ITG Line 2.0 card

Replace the ITG Line 2.0 card when the following conditions occur, or the card is removed for other reasons:

- If, following a reboot, the ITG Line 2.0 card displays a code of the form “F:xx” on the faceplate LED display, this indicates an unrecoverable hardware failure and the card will not register with the Meridian 1. The exception is the “F:10” code, which may indicate that the Security Device is missing from the card.
- If the management Ethernet interface or the voice Ethernet interface on the ITG Line 2.0 card has failed. This can be indicated by failure to show a link pulse on the voice IP interface status LED, or on the hub, or if the maintenance port continuously prints ‘InIsa0 Carrier Failure’ messages, after proving that the hub port and T-LAN cable are good.

- If a voice channel on the ITG Line 2.0 card has a consistent voice quality fault, such as persistent noise or lack of voice path, even after resetting the card and retransmitting the card properties.

**Procedure 45****Replacing an ITG line card**

- 1 Before replacing the ITG line card, first remove it for 2-3 seconds and then reseat the card in the IPE shelf in order to perform a power-on reset. If the failure persists, there is no option but to replace the card. Continue with the following steps.
- 2 Locate the faulty card in the MAT/OTM ITG database by the TN, MAC address, and IP address.
- 3 Disable the faulty ITG Line 2.0 card in Overlay 32 with the **DISI** command. The Meridian outputs "NPR0011" when the card has been completely disabled by the DISI command.
- 4 Remove the faulty ITG Line 2.0 card from the Meridian 1.

**Note:** This will force all i2004 Internet telephones registered on this card to re-register. If there are sufficient resources this can take up to several minutes. If there are not sufficient resources, the i2004 Internet Telephones can remain unregistered indefinitely.

- 5 Select Leader 0 or any ITG Line 2.0 card in the node.
- 6 Click **Configuration | Node | Properties** in the "IP Telephony Gateway" window.
- 7 Click the **Card Configuration** tab in the "ITG Node Properties" window.
- 8 In the "Card Configuration" tab, select the faulty ITG Line 2.0 card from the list of cards in the node.
- 9 Change the "Management MAC" to the MAC address of the replacement ITG Line 2.0 card. The MAC address is the Motherboard Ethernet address labeled on the faceplate of the replacement ITG Line 2.0 card.
- 10 Click **OK**.
- 11 Select Leader 0 or any ITG Line 2.0 card in the node.

- 12 Use the **Configuration | Synchronize | Transmit** command to transmit the Node Properties from MAT/OTM to the active leader card (Leader 0 or Leader 1) of the ITG node. Leave the default radio button selection "Transmit to Selected Nodes". Check the **Node Properties** box, and then click **Start Transmit**. This will update the node properties on the active leader card with the MAC Address of the replacement ITG Line 2.0 card.
- 13 Install the replacement ITG Line 2.0 card into the card slots in the Meridian 1 IPE module or Option 11 cabinet:
  - a Pull the top and bottom locking devices away from the ITG faceplate.
  - b Insert the ITG Line 2.0 card into the card guides and gently push it until it makes contact with the backplane connector. Hook the locking devices.

**Note 1:** When ITG Line 2.0 cards are installed, the red LED on the faceplate remains lit until the card is configured and enabled in software, at which point it turns off. If the LED does not follow the pattern described or operates in any other manner (such as continually flashing or remaining weakly lit), replace the card.

**Note 2:** Observe the ITG faceplate maintenance display to see startup selftest results and status messages. A display of the type "F:xx" indicates a failure. Refer to Table 30 on page 207 for a listing of display codes.
- 14 In the MAT/OTM "IP Telephony Gateway" main window, select **View | Refresh** and verify that the replacement ITG Line 2.0 card status is showing "Unequipped."

————— *End of Procedure* —————

## Verify ITG card software and firmware

### Procedure 46

#### Verifying ITG card software and firmware

- 1 Check the M1 ESD website for the latest recommended ITG software and firmware release. The URL address is:  
**"<http://www.nortelnetworks.com/servsup/esd/meridian1>"**  
  
The default user name is **usa**. The default password is **usa**. See your Nortel Network representative to register for a new default name and password if the default does not work.
- 2 Navigate through the site until you reach the Release Notes and associated software and firmware zip files. The Release Notes contain the latest versions of software and firmware. Make a note of this information to compare against the ITG card.
- 3 In the "IP Telephony Gateway" window, double-click the replacement ITG Line 2.0 card to open the "Card Properties".
- 4 Leave the default selection of the ITG Line 2.0 card in the "Card Properties" window, and click the "Configuration" tab.
- 5 Verify that the "S/W release" shows the latest recommended ITG Line 2.0 card software version. Verify the i2004 Internet Telephone firmware is the latest recommended release.
- 6 Upgrade the software and/or firmware if required. Refer to "Upgrade ITG Line card software from the web" on page 153 and "Upgrade i2004 Internet Telephone firmware" on page 156.

————— *End of Procedure* —————

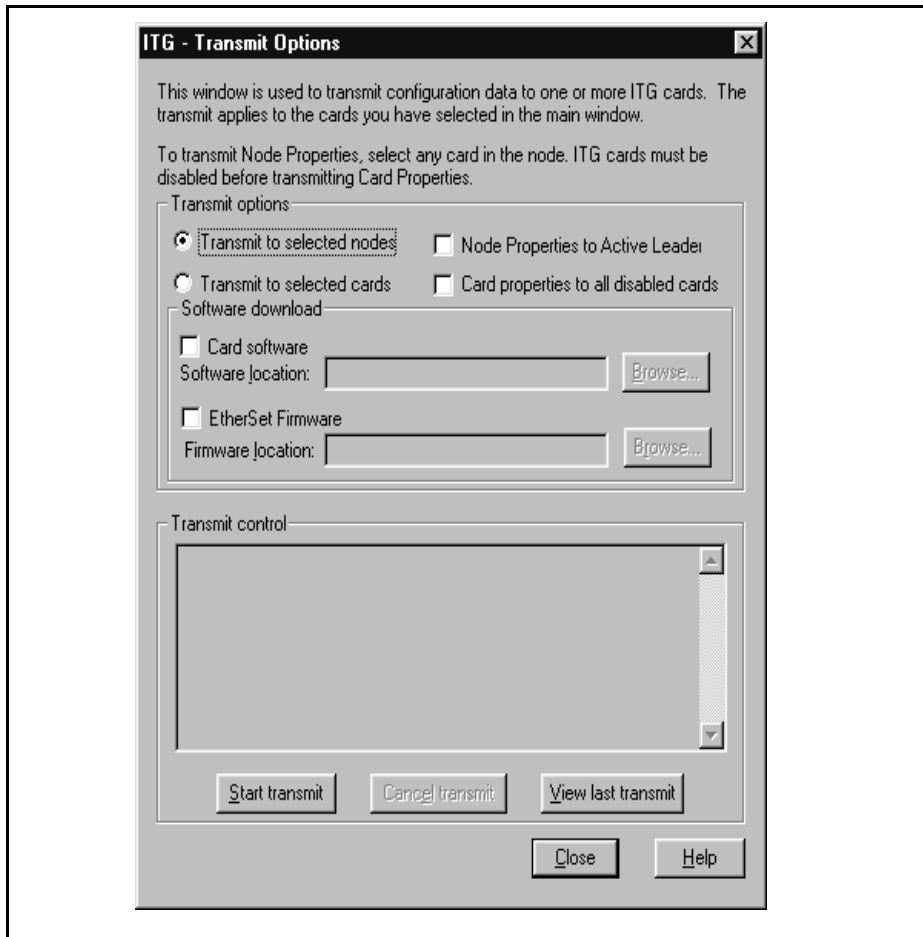
## Transmitting card properties

### Procedure 47

#### Transmitting Card Properties

- 1 In the "IP Telephony Gateway" window, select the replacement ITG Line 2.0 card.
- 2 Click **Configuration | Synchronize | Transmit**.
- 3 The "ITG - Transmit Options" window appears (Figure 35).

**Figure 35**  
**ITG Transmit Options dialog box**



- 4 Select the radio button “Transmit to selected cards”. Check the “Card properties” boxes only.
- 5 Click the **Start Transmit** button.  
The transmission status is displayed in the “Transmit control” box. Confirm that Card Properties are transmitted successfully.
- 6 When the transmission is complete, click the **Close** button.



- 7 Use the Overlay 32 ENLC command to re-enable the ITG Line 2.0 card.
- 8 In the "IP Telephony Gateway" main window, select **View | Refresh**. The card status now shows "Enabled."
- 9 Update the Installation Summary Sheet with the new MAC address.
- 10 Verify the TN, management interface MAC address and IP address for each ITG Line 2.0 card. Compare the displayed values with those on the ITG Installation Summary Sheet.

————— *End of Procedure* —————

## Access the command line from MAT

### Procedure 48

#### Telnet to an ITG Line 2.0 card

- 1 In the "MAT/OTM Navigator" window select the **ITG IP Phones** icon from the "Services" folder.
- 2 In the "IP Telephony Gateway - IP Phones" window click the right mouse button on the ITG Line 2.0 card that you wish to access and select **Card | Telnet to IP Telephony Gateway Line 2.0 card** from the popup menu.
- 3 Enter the default user name and password: **itgadmin**.

The MAT/OTM PC opens a Telnet window and automatically connects to the ITG Line 2.0 card by using the management IP address. After entering a username and password, the ITG shell command-line interface is accessed from the MAT/OTM PC.

————— *End of Procedure* —————

## Adding a “dummy” node for retrieving and viewing ITG node configuration

Use this procedure to create a “dummy” ITG node for retrieving and viewing the actual ITG node configuration, without over-writing the existing ITG configuration data for an existing node in the MAT/OTM ITG database.

Retrieving the actual ITG node configuration to the “dummy” node is useful in the following cases:

- To isolate ITG node configuration faults
- To determine which copy of the database is correct, in order to determine the desired direction of database synchronization:
  - transmit MAT/OTM ITG to ITG node, or
  - retrieve ITG node to MAT/OTM ITG node.

The dummy node can be added manually or by retrieving the ITG node configuration data from an existing node.

The site name, Meridian 1 system name, and Meridian 1 customer number must exist in the MAT/OTM Navigator before you can add a new ITG node.

The following Procedure 49 on page 218 is the recommended method to create the “dummy” ITG node.

### **Procedure 49**

#### **Creating the “dummy” ITG node to retrieve actual configuration:**

- 1 In MAT/OTM Navigator add a site named “Retrieve ITG data.”
- 2 Add system named “Dummy,” of type “Meridian 1,” under the site named “Retrieve ITG data.”
- 3 Add Customer Number “99” on the “dummy” Meridian 1 system.
- 4 To view the actual data, select the “dummy” node and change the management IP address in the node properties to access the desired node.

- 5 Use the **Configuration|Synchronize|Retrieve** function to retrieve data from that node.
- 6 Confirm to over-write the MAT/OTM ITG data for the “dummy” node.

————— *End of Procedure* —————

## Retrieving ITG configuration information from the ITG node

The following Procedure on page 219, is an optional procedure that may be used in the following cases:

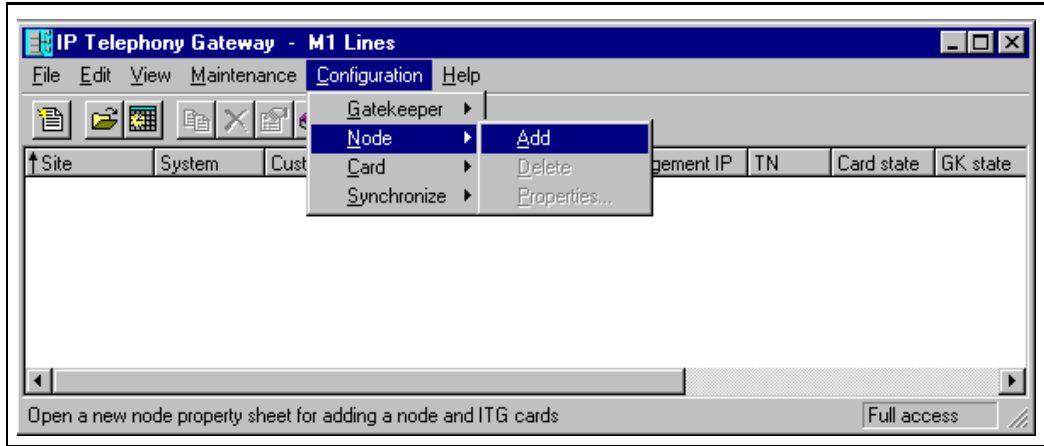
- When adding an ITG node on MAT/OTM by retrieving an existing node
- When you suspect that the ITG node configuration on the ITG Line 2.0 card differs from the MAT/OTM ITG database (for example, during maintenance and fault isolation procedures).
- When you have multiple MAT/OTM ITG PCs with multiple instances of the database (administration).

### Procedure 50

#### Retrieving ITG configuration data from the ITG node

- 1 Use the MAT/OTM ITG **Configuration|Synchronize|Retrieve** command to retrieve the ITG configuration information from the ITG node.
- 2 Launch the Meridian Administration Tools application on the MAT/OTM PC.
- 3 From the “MAT/OTM Navigator” window, double-click the **IP Telephony Gtwy** icon from the “Services” folder. The “IP Telephony Gateway” window opens.
- 4 In the “IP Telephony Gateway - M1 Lines” window, select Leader 0 or any card from the node.
- 5 In the “IP Telephony Gateway - M1 Lines” window, click the **Configuration** menu and select **Synchronize**, then **Retrieve**.  
The “ITG - Retrieve Options” window appears.

**Figure 36**  
**ITG main window - Node Add**



- 6 Leave the defaulted "Retrieve to selected nodes" option selected, or click the "Retrieve from selected cards," depending upon the situation:
  - a Leave the defaulted "Retrieve to selected nodes" when the MAT/OTM ITG data is out of date and you intend to synchronize all MAT/OTM ITG node data with the data from the ITG Line 2.0 cards on the node, or if you are adding a node on MAT/OTM by retrieving from an existing node that consists of more than one card.
  - b Select "Retrieve from selected card" when you are attempting to isolate a problem with ITG configuration on a particular card.
- 7 Check the boxes for the ITG configuration data that you wish to retrieve, depending upon the situation:
  - a Select "Node Properties," "GK Properties" and "Card Properties," if the MAT/OTM ITG data is out of date and you intend to synchronize all MAT/OTM ITG node data with the data from the ITG Line 2.0 cards on the node.
  - b Select "Card Properties" if you are adding a node on MAT/OTM by retrieving from an existing node that consists of more than one card.
  - c Select any combination of check boxes as indicated by problem symptoms when you are attempting to isolate a problem on a particular card. Use the "dummy" node for this purpose.

- 8 Click the **Start retrieve** button.
- 9 Monitor the progress of the retrieval in the "Retrieve control" box.  
The retrieved "Node Properties," "GK Properties" and "Card Properties," will over-write the existing MAT/OTM ITG configuration data for the respective node or card.

The "Retrieving the ITG configuration information from the ITG node" procedure is complete.

————— *End of Procedure* —————

## **ITG Line 2.0/i2004 Internet Telephone maintenance and diagnostics - LD 32**

In the i2004 Internet Telephone, there are two kinds of TNs to consider:

- Physical TN, which represents a physical unit of the ITG card
- Vitriol TN, which is configured on a virtual superloop and represents an i2004 Internet Telephone

Physical TNs, that are seen as trunk units, are managed using existing LD 32 commands.

Because virtual TNs are configured on a virtual superloop, Virtual TN maintenance has no meaning. That is what is already provided by the Meridian 1 for phantom loops. In Overlay 32, any command affecting a phantom loop leads to an NTP665 message, since the loop does not physically exist. Overlay 32 supports STAT, DISU, ENLU and IDU commands on an i2004 Internet Telephone Virtual TN. All other commands lead to the new NPR047 message.

The IDU command provides the usual information, such as TN, TNID, NT code, color code, release code and serial number, as well as the IP address of the i2004 Internet Telephone and the IP address of the ITG card that is acting as the terminal proxy. The serial number is the last three bytes of the i2004 Internet Telephone's MAC address, printed in ASCII hex format.

Because Meridian 1 must request the information from the i2004 Internet Telephone, the IDU is effectively a "ping" command and can be used to test the end-to-end IP connectivity of the i2004 Internet Telephone. The output format of the IDU command in LD32 is shown in Table 32. This format only applies for i2004 Internet Telephone Virtual TNs. Table 33 contains the maintenance commands in LD32 for the i2004 Internet Telephone.

If the i2004 Internet Telephone is not registered with the Meridian 1, an NPR0048 message is generated. If the i2004 Internet Telephone is registered but idle, the system prints the i2004 Internet Telephone IP address and ITG card IP address and generates an NPR0053 message.

**Table 32**  
**IDU command printout in LD 32**

| Item        | Description     |
|-------------|-----------------|
| ISet TN:    | I s c u         |
| TN ID CODE: | I2004           |
| NT CODE:    | xxxxxx          |
| COLOR CODE: | xx              |
| RLS CODE:   | xx              |
| SER NUM:    | xxxxxxx         |
| SET IP ADR: | xxx.xxx.xxx.xxx |
| TPS IP ADR: | xxx.xxx.xxx.xxx |

**Table 33**  
**LD 32 Maintenance Commands for the i2004 Internet Telephone**

| Prompt               | Response                                                                                                                                                                                      | Description                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| STAT lscu<br>STAT cu | UNEQ<br>IDLE REGISTERED<br>IDLE UNREGISTERED.<br>BUSY,<br>DSBL REGISTERED<br>DSBL UNREGISTERED                                                                                                | Display the i2004 Internet Telephone state.<br>UNEQ, IDLE, BUSY and DSBL have the usual meaning.<br><br>IDLE and DSBL state are precise by the following information: <ul style="list-style-type: none"> <li>• UNREGISTERED identifies an i2004 Internet Telephone that is configured in the system but that has not yet registered.</li> <li>• REGISTERED identifies an i2004 Internet Telephone that has registered.</li> </ul> |
| DISU lscu<br>DISU cu | OK                                                                                                                                                                                            | Change the i2004 Internet Telephone state to DSBL. UNREGISTERED/REGISTERED state is not modified.                                                                                                                                                                                                                                                                                                                                 |
| ENLU lscu<br>ENLU cu | OK                                                                                                                                                                                            | Change the i2004 Internet Telephone state to IDLE. UNREGISTERED/REGISTERED state is not modified.                                                                                                                                                                                                                                                                                                                                 |
| IDU lscu<br>IDU cu   | Displays the TN number, device code, NT code, color code, release code, last three bytes of MAC address. Displays the IP address for i2004 Internet Telephones and the Terminal Proxy Server. | Displays selected i2004 information.                                                                                                                                                                                                                                                                                                                                                                                              |

## ITG line shell commands

ITG line shell commands are designed to supplement overlay commands, and to introduce new features specific to the ITG platform.

The ITG shell commands are accessed by connecting a TTY to the MAINT port on the ITG Line 2.0 card faceplate. Alternatively, the MAT/OTM ITG “Telnet” command can be used to access the ITG shell.

Commands are grouped into six categories:

- “General purpose commands:” on page 224
- “File transfer commands” on page 225
- “IP configuration commands:” on page 228
- “Reset commands:” on page 228
- “DSP commands” on page 229

The command line prompt is ITGL. Table 34 list the ITG shell commands applicable to the ITG Line 2.0 card.

**Table 34**  
**ITG Line 2.0 ITGL shell commands (Part 1 of 6)**

| =>Command                        | Description                                                                                                                                    |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>General purpose commands:</b> |                                                                                                                                                |
| <b>itgCardShow</b>               | Displays card info.                                                                                                                            |
| <b>itgMemShow</b>                | Displays memory usage                                                                                                                          |
| <b>ifShow</b>                    | Displays detailed IP information, including MAC addresses.                                                                                     |
| <b>IPInfoShow</b>                | Displays IP information.                                                                                                                       |
| <b>serialNumShow</b>             | Displays card serial number.<br><br>This command displays the same ITG Line 2.0 card serial number that is displayed in the LD 32 IDC command. |
| <b>itgfwShow</b>                 | Displays firmware version number.                                                                                                              |
| <b>itgsetfwShow</b>              | Displays i2004 Internet Telephone firmware.                                                                                                    |



**Table 34**  
**ITG Line 2.0 ITGL shell commands (Part 2 of 6)**

| =>Command                                                                          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>numChannelsShow</b>                                                             | Displays number of available channels.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>swVersionShow</b>                                                               | Displays software version.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>resetOm</b>                                                                     | Resets the operational measurement file timer. This command will reset all operational measurement parameters collected since last log dump.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>logFileOn</b>                                                                   | Turns on error logging to the file.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>logFileOff</b>                                                                  | Turns off error logging to the file.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>logShow</b>                                                                     | Indicates whether logging is on or off.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>logConsoleOn</b>                                                                | Turns on error logging to the console.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>logConsoleOff</b>                                                               | Turns off error logging to the console                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>isetShow</b>                                                                    | Displays the general info for all the i2004 Internet Telephones that have registered, for example, IP address of the i2004 Internet Telephone, VTN that the i2004 Internet Telephone is associated with.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>itgBandwidthShow</b>                                                            | Displays the bandwidth consumption.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>File transfer commands</b>                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>swDownload</b> "hostname", "username", "password", "directory path", "filename" | <p>Updates the software on the ITG Line 2.0 card with the binary file received from an FTP server corresponding to the <i>hostname</i> IP address. The ITG Line 2.0 card ftp client performs a get which downloads the file to the ITG flash bank. A checksum is calculated to verify correct delivery. Once the new software version is successfully downloaded, the ITG Line 2.0 card must be rebooted with <b>cardReset</b> in order to run the new software.</p> <p><b>Note:</b> <i>Hostname</i> refers to the either IP address of the FTP host, or the ITG Line 2.0 card itself or another ITG Line 2.0 card when a PC card in the A: drive of the ITG Line 2.0 card contains the software binary file.</p> <p>ITGL&gt;<b>swDownload</b> "47.82.32.346", "anonymous", "guest", "/software", "vxWorks.mms"</p> <p><i>Example:</i></p> |

**Table 34**  
**ITG Line 2.0 ITGL shell commands (Part 3 of 6)**

| =>Command                                                                                                                                    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>configFileGet</b> "hostname",<br>"username", "password",<br>"directory path", "filename"<br><br><i>Example:</i>                           | Updates the config.ini file on the ITG Line 2.0 card with the config.ini file on the specified host, account and path. The configFileGet task on the ITG host initiates an FTP session with the given parameters and downloads the file to flash file system. The config.ini file also contains the gatekeeper IP address, gateway password, and gateway DN-port mapping table.<br><br>ITGL> <b>configFileGet</b> "ngals042", "anonymous", "guest",<br>"/configDir", "config.ini" |
| <b>bootPFileGet</b> "hostname",<br>"username", "password",<br>"directory path", "filename"<br><br><i>Example:</i>                            | Updates the bootptab file on the ITG Line 2.0 card with the bootptab file on the specified host, account and path. The bootPFileGet task on the ITG host initiates an FTP session with the given parameters and downloads the file to flash file system.<br><br>ITGL> <b>bootPFileGet</b> "ngals042", "anonymous", "guest",<br>"/bootpDir", "bootptab"                                                                                                                            |
| <b>hostFileGet</b> "hostname",<br>"username", "password",<br>"directory path", "filename",<br>"ITGFileName", listener<br><br><i>Example:</i> | Gets any file from the host and does a Get via FTP to the ITG Line 2.0 card.<br><br><b>Note:</b> ITGFileName is the full path AND filename of where the file is to be placed. The listener parameter indicates which module to inform of the successful file transfer. It can be set to -1 to be disabled.<br><br>ITGL> <b>hostFileGet</b> "ngals042", "anonymous", "guest",<br>"/hostfileDir", "hostFile.txt",<br>"/C:ITGFILRDIR/ITGFILE.TXT", -1                                |
| <b>currOmFilePut</b> "hostname",<br>"username", "password",<br>"directory path", "filename"<br><br><i>Example:</i>                           | The omFilePut task on the ITG host initiates an FTP session with the given parameters and downloads the ITG Line 2.0 card's operational measurements file to the specified location on the host.<br><br>ITGL> <b>currOmFilePut</b> "ngals042", "anonymous", "guest",<br>"/currDir", "omFile"                                                                                                                                                                                      |

**Table 34**  
**ITG Line 2.0 ITGL shell commands (Part 4 of 6)**

| =>Command                                                                                                                                     | Description                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>prevOmFilePut</b> "hostname",<br/> "username", "password",<br/> "directory path", "filename"</p> <p><i>Example:</i></p>                 | <p>The omFilePut task on the ITG host initiates an FTP session with the given parameters and downloads the ITG Line 2.0 card's operational measurements file to the specified location on the host.</p> <p>ITGL&gt; <b>prevOmFilePut</b> "ngals042", "anonymous", "guest",<br/> "/prevDir", "omFile"</p> |
| <p><b>traceFilePut</b> "hostname",<br/> "username", "password",<br/> "directory path", "filename"</p> <p><i>Example:</i></p>                  | <p>The traceFilePut task on the ITG host initiates an FTP session with the given parameters and downloads the ITG Line 2.0 card's call trace file to the specified location on the host.</p> <p>ITGL&gt; <b>traceFilePut</b> "ngals042", "anonymous", "guest",<br/> "/trcDir", "trcFile"</p>             |
| <p><b>LogFilePut</b> "hostname",<br/> "username", "password",<br/> "directory path", "filename"</p> <p><i>Example:</i></p>                    | <p>The logFilePut task on the ITG host initiates an FTP session with the given parameters and downloads the ITG Line 2.0 card's logfile the to specified location on the host.</p> <p>ITGL&gt; <b>currLogFilePut</b> "ngals042", "anonymous", "guest",<br/> "/currDir", "logFile"</p>                    |
| <p><b>bootPFilePut</b> "hostname",<br/> "username", "password",<br/> "directory path", "filename"</p> <p><i>Example:</i></p>                  | <p>Sends the bootptab file from the ITG Line 2.0 card to MATMAT/OTM.</p> <p>ITGL&gt; <b>bootPFilePut</b> "ngals042", "anonymous", "guest",<br/> "/bootpDir", "bootpFile"</p>                                                                                                                             |
| <p><b>hostFilePut</b> "hostname",<br/> "username", "password",<br/> "directory path", "filename",<br/> ITGFileName</p> <p><i>Example:</i></p> | <p>Transfers any file from the ITG Line 2.0 card to the MAT/OTM PC.</p> <p>ITGL&gt; <b>hostFilePut</b> "ngals042", "anonymous", "guest",<br/> "/hostDir", "hostFile", "/C:/CONFIG/CONFIG1.INI"</p>                                                                                                       |
| <p><b>fwFilePut</b></p>                                                                                                                       | <p>Transfer the firmware file from the ITG Line 2.0 card to the i2004 Internet Telephone.</p>                                                                                                                                                                                                            |

**Table 34**  
**ITG Line 2.0 ITGL shell commands (Part 5 of 6)**

| =>Command                  | Description                                                                                                                                                   |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IP configuration commands: |                                                                                                                                                               |
| NVRIPSet                   | Sets the IP address in NVRAM.                                                                                                                                 |
| NVRGWSet                   | Sets the default gateway address in NVRAM.                                                                                                                    |
| NVRSMSet                   | Sets the subnet mask in NVRAM.                                                                                                                                |
| NVRIPShow                  | Prints the values of the IP parameters that reside in NVRAM.                                                                                                  |
| nvrnLeaderSet              | Sets the leader bit in NVRAM.                                                                                                                                 |
| nvrnLeaderClr              | Clears the leader bit in NVRAM, but does not erase the IP parameters in NVRAM.                                                                                |
| NVRClear                   | Clear IP parameters in NVRAM.                                                                                                                                 |
| setLeader                  | The one command that does all the necessary actions to make a leader. Sets IP address, gateway, subnet mask, boot method to static, and leader bit in NVRAM.  |
| clearLeader                | The one command that does all the necessary actions to clear the leader info in NVRAM and set the boot method to use bootp, thus, making the card a follower. |
| Reset commands:            |                                                                                                                                                               |
| cardReset                  | Performs a warm reboot of ITG Line 2.0 card. The card must be in the OOS state to use this command.                                                           |
| isetReset "tn" l s c u     | - large systems   Resets the i2004 Internet Telephone                                                                                                         |
| isetReset "tn" c u         | - small systems                                                                                                                                               |

**Table 34**  
**ITG Line 2.0 ITGL shell commands (Part 6 of 6)**

| <b>=&gt;Command</b>              | <b>Description</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ping "host", "numpackets"</b> | <p>This command sends an ICMP ECHO_REQUEST packet to a network host. The host matching the destination address in the packets will respond to the request. If a response is not returned, the sender will time out. This command is useful to determine if other hosts or ITG cards are communicating with the sender card. The "numpackets" parameter specifies how many packets to send. If it is not included, ping runs until it is stopped by Ctrl-C (which also exits the ITGL shell).</p> <p>Example: ITGL&gt;<b>ping</b> "47.82.33.123", 10</p> |
| <b>DSP commands</b>              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>DSPReset</b>                  | Resets the specified DSP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>DSPSelfTest</b>               | Runs selftest on the DSP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>DSPNumShow</b>                | Prints number of DSPs on ITG Line 2.0 card.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>DSPPCmLpbkTestOn</b>          | Stops pcm loopback test on the specified DSP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>DSPPCmLpbkTestOff</b>         | Stops pcm loopback test on the specified DSP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>DSPSndLpbkTestOn</b>          | Starts Send loopback test on the specified DSP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>DSPSndLpbkTestOff</b>         | Stops Send loopback test on the specified DSP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>DSPRcvLpbkTestOn</b>          | Starts Receive loopback test on the specified DSP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>DSPRcvLpbkTestOff</b>         | Stops Receive loopback test on the specified DSP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>itgCodecShow</b>              | <p>Displays the codec parameters:</p> <ul style="list-style-type: none"> <li>• codec value</li> <li>• maximum number of frames/packets</li> <li>• depth of jitter buffer</li> </ul>                                                                                                                                                                                                                                                                                                                                                                     |

## ITG Line 2.0 card selftests

During power-up, the ITG Line 2.0 card performs diagnostic tests to ensure correct operation. The faceplate RS-232 port on the ITG Line 2.0 card can be used to monitor the progress of these tests. When the 486 processor responds correctly, the 8051XA controller will switch its serial port to provide Card LAN communication and connect the 486 processor with the external RS-232 port.

## Troubleshooting a software load failure

### Symptoms

MAT/OTM cannot establish connection with ITG Line 2.0 card. The faceplate LCD display reads "BIOS."

### Problem

The ITG Line 2.0 card has booted the BIOS load.

### Diagnosis

In the event of a failure to load and run the ITG software, the ITG Line 2.0 card defaults to the BIOS load. This load consists of a prompt that allows commands to reload the ITG software and reboot (see below).

There are three known reasons that can cause the failure to load the ITG software:

- Not enough memory due to a faulty or missing SIMM.
- Corruption of the ITG software image in flash memory.
- The escape sequence to boot from the BIOS has been inadvertently sent down the serial line due to noise.

To determine which of the three causes caused the ITG load failure, reboot and monitor the booting sequence through the serial port. Capture the booting sequence to aid in communication with technical support personnel.

**Examples of booting sequences:**

**Case 1:** The following excerpt from the booting sequence indicates the amount of memory onboard.

Memory Configuration  
Onboard: 4MB  
SIMM: 16MB  
Total: 20MB

In the absence or failure of the SIMM, the total memory is 4MB, which is not enough to support the ITG application.

**Case 2:** The following excerpt from the booting sequence indicates the ITG Line 2.0 card locating and loading the ITG software from flash memory:

Cookie array value: 0x11111100

Checksum Validation at Bank Address: 0xF9800000  
Checksum in ROM = 35582602  
Length of bank = 0004FEF8  
Calculated Checksum = 35582602

Checksum array value: 0x11111100

Loading code from address: F9800010  
Verifying ROM to RAM copy...  
ROM to RAM copy completed OK  
Jumping to VxWorks at 0x00E00000  
EIP = 0x00E0011E  
Jumping to romStart at 0x00E00300

In the event of a software load failure, the boot sequence indicates that the BIOS is being loaded:

Cookie array value: 0x11111111  
Booting from BIOS ROM

**Case 3:** The boot sequence indicates that the "xxx" sequence has been entered and the BIOS is being loaded:

## Solutions

**Case 1:** If a SIMM is missing, install a 16MB SIMM into the SIMM slot which is found underneath the ITG daughterboard. If the SIMM is present, check that the SIMM is properly seated. Otherwise, the SIMM is faulty and needs replacement.

**Case 2:** Re-attempt a software download from the MAT/OTM host. Use the following commands:

```
upgradeErase
upgrade "hostname","hostAccount","hostPassword",
 "hostDirectoryPath","hostSWFilename"
```

After the software loads to flash, reboot the card:

```
sysReboot
```

If the failure to load the ITG software into RAM persists, then the flash device is faulty. Replace the ITG Line 2.0 card.

**Case 3:** The escape sequence "xxx" is rarely transmitted. Reboot the card.

## Warm rebooting the ITG Line 2.0 card

The following ITG shell command performs a warm reboot of an out-of-service ITG Line 2.0 card: **cardReset**

## Test the ITG Line 2.0 card DSPs

At the ITG shell, the following two tests can be performed on the ITG DSPs:

- To run a selftest on the DSP daughterboard: **DSPselfTest**  
*Note:* If the DSP self test fails, the ITG Line 2.0 card must be replaced.
- To run a PCM loopback test, a Send loopback test, or a Receive loopback test on the DSP daughterboard, respectively:

**DSPPCmLpbkTestOn** ("DSPPcmLpbkTestOff" to stop the test)

**DSPSndLpbkTestOn** ("DSPSndLpbkTestOff" to stop the test)

**DSPRcvLpbkTestOn** ("DSPRcvLpbkTestOff" to stop the test)

*Note:* The DSPs and all associated ports must be disabled before performing these tests.



## Work with alarm and log files

Alarm and log file output is turned on via the ITG shell. The following commands may be performed at the ITG shell prompt:

- to turn on/off the error log file, type: **logFileOn** or **logFileOff**.
- to display the modes of all log files/alarms, type: **logFileShow**.



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## Appendix A: I/O, maintenance and extender cable description

---

### Contents

This section contains information on the following topics:

|                                                                             |     |
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| Connector pin assignments .....                                             | 238 |
| Prevent ground loops on connection to external customer LAN equipment ..... | 241 |
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| Removing an NT8D81BA cable .....                                            | 245 |
| Installing an NTCW84JA filter and NT8D81AA cable .....                      | 246 |

### Overview

This appendix describes the NTMF94EA, NTAG81CA and NTAG81BA cables and explains how to replace the NT8D81BA backplane ribbon cable and install the NTCW84JA filter, if required.

### NTMF94EA I/O cable

The NTMF94EA provides the E-LAN, T-LAN ports that provide the interface from the IP Line card to the customer's network equipment, and one DB9 serial port that provides serial connection between the card and the customer PC or TTY (see Figure 35). Table 36 describes the NTMF94EA cable pins.

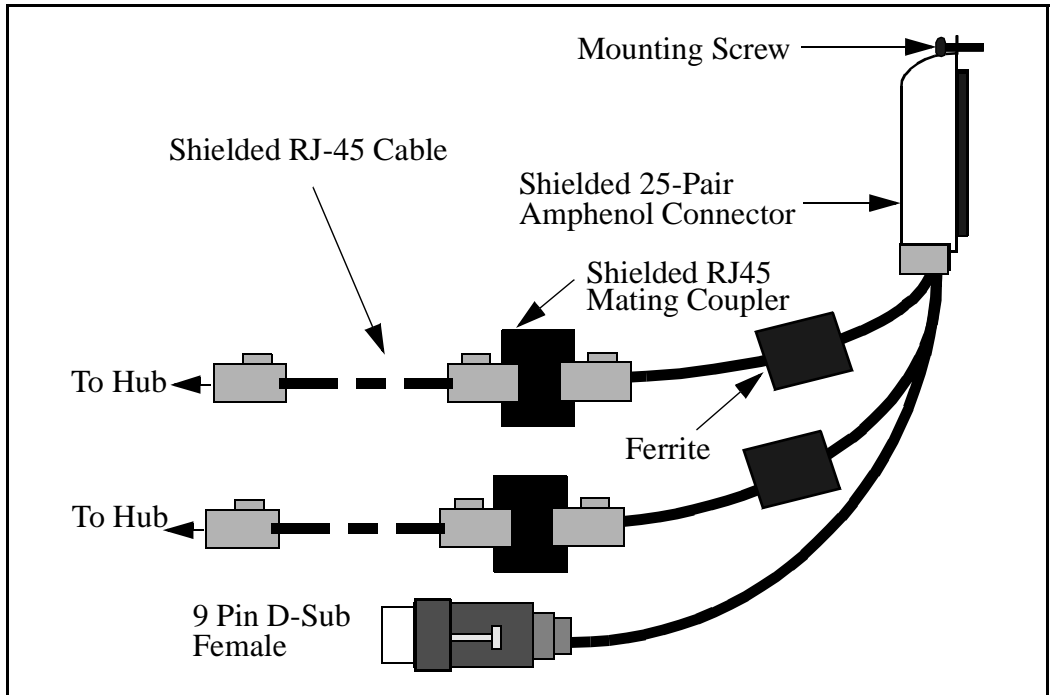
It is important to use the mounting screw provided to secure the top of the NTMF94EA cable 25-pair Amphenol connector to the Meridian 1. The screw ties the LAN cable shield to the Meridian 1 frame ground for EMC compliance.

The NTMF94EA cable provides a factory installed, shielded, RJ45 to RJ45 coupler at the end of both the E-LAN and T-LAN ports. An unshielded coupler is provided to prevent ground loops (if required). Turn to page 241, to determine if you have to use the unshielded coupler. Both ends of the RJ45 ports of the cables are labeled as to which is the T-LAN and which is the E-LAN. The ports provide the connection point to the customer's E-LAN and T-LAN equipment. You must use shielded Category 5 cable to connect to the customer's equipment.

To improve EMC performance, use standard cable ties to bundle all LAN cables as they route out of the system.

**Note:** To avoid damage to Category 5 cable, do not overtighten cable ties.

**Table 35**  
**NTMF94EA E-LAN, T-LAN and RS-232 Serial Maintenance I/O cable**



Connector pin assignments

Table 36 shows the I/O connector pin designations for the ITG Line 2.0 card.

Table 36  
 ITG I/O Panel Pinout (Part 1 of 2)

| Pin | Normal Assignment | ITG Assignment | Pin | Normal Assignment | ITG Assignment |
|-----|-------------------|----------------|-----|-------------------|----------------|
| 2   | R1                | Not Used       | 26  | T0                | Not Used       |
| 3   | R2                | Not Used       | 27  | T1                | Not Used       |
| 4   | R3                | Not Used       | 28  | T2                | Not Used       |
| 5   | R4                | Not Used       | 29  | T3                | Not Used       |
| 6   | R5                | AGND           | 30  | T4                | AGND           |
| 7   | R6                | Not Used       | 31  | T5                | Not Used       |
| 8   | R7                | Not Used       | 32  | T6                | Not Used       |
| 9   | R8                | Not Used       | 33  | T7                | Not Used       |
| 10  | R9                | AGND           | 34  | T8                | AGND           |
| 11  | R10               | PGT0           | 35  | T9                | PGT1           |
| 12  | R11               | PGT2           | 36  | T10               | PGT3           |
| 13  | R12               | PGT4           | 37  | T11               | PGT5           |
| 14  | R13               | PGT6           | 38  | T12               | PGT7           |
| 15  | R14               | PGT8           | 39  | T13               | PGT9           |
| 16  | R15               | PGT10          | 40  | T14               | PGT11          |

**Table 36**  
**ITG I/O Panel Pinout (Part 2 of 2)**

| Pin | Normal Assignment | ITG Assignment | Pin | Normal Assignment | ITG Assignment |
|-----|-------------------|----------------|-----|-------------------|----------------|
| 17  | R16               | SGNDA          | 41  | T15               | BDCDA-         |
| 18  | R17               | BSINA-         | 42  | T16               | BSOUTA-        |
| 19  | R18               | BDTRA-         | 43  | T17               | SGND           |
| 20  | R19               | BDSRA-         | 44  | T18               | BRTSA-         |
| 21  | R20               | BCTSA-         | 45  | T19               | BSINB-         |
| 22  | R21               | BSOUTB-        | 46  | T20               | BDCDB-         |
| 23  | R22               | BDTRB-         | 47  | T21               | BDSRB-         |
| 24  | R23               | DI+            | 48  | T22               | DI-            |
| 25  | no connect        | DO+            | 49  | T23               | DO-            |
| 2   | R1                | no connect     | 50  | no connect        | no connect     |

**Table 37**  
**NTMF94EA cable pin description (Part 1 of 2)**

| I/O Panel: P1 | Signal Name | P2, P3,P4 | Color  |
|---------------|-------------|-----------|--------|
| P1-21         | BSOUTB-     | P2-2      | RED    |
| P1-22         | BDTRB-      | P2-4      | GREEN  |
|               | SGRND       | P2-5      | BROWN  |
| P1-45         | BSINB-      | P2-3      | BLUE   |
| P1-46         | BDCDB-      | P2-1      | ORANGE |
| P1-47         | BDSRB-      | P2-6      | YELLOW |

**Table 37**  
**NTMF94EA cable pin description (Part 2 of 2)**

| I/O Panel: P1 | Signal Name | P2, P3,P4 | Color   |
|---------------|-------------|-----------|---------|
| P1-25         | SHLD GRND   |           |         |
| P1-50         | SHLD GRND   |           |         |
|               |             |           |         |
| P1-18         | RXDB+       | P4-3      | GRN/WHT |
| P1-19         | TXDB+       | P4-1      | ORG/WHT |
| P1-43         | RXDB-       | P4-6      | WHT/GRN |
| P1-44         | TXDB-       | P4-2      | WHT/ORG |
|               |             |           |         |
| P1-23         | RX+         | P3-3      | GRN/WHT |
| P1-24         | TX+         | P3-1      | ORG/WHT |
| P1-48         | RX-         | P3-6      | WHT/GRN |
| P1-49         | TX-         | P3-2      | WHT/ORG |
| P1-25         | SHLD GRND   |           | BARE    |
| P1-50         | SHLD GRND   |           | BARE    |



---

## Prevent ground loops on connection to external customer LAN equipment

The shielded RJ45 coupler is the connection point for the customer's shielded Category 5 LAN cable to the hub, switch, or router supporting the T-LAN and E-LAN. You must use shielded Category 5 RJ45 cable to connect to the customer's T-LAN/E-LAN equipment.

- 1 Connect the customer-provided shielded Category 5 LAN cable to the external LAN equipment. Ensure that the external LAN equipment is powered-up.
- 2 Use an ohmmeter to measure resistance to ground between the free end of the shielded RJ45 cable and building ground.  
  
The ohmmeter *must* measure Open to ground before plugging it into the shielded RJ45 coupler on the end of the NTMF94EA.
- 3 If it does *not* measure Open, you must install the unshielded RJ45 coupler (provided) on the end of the NTMF94EA to prevent ground loops to external LAN equipment.

### WARNING

The serial maintenance ports on the faceplate connector and the DB-9 female connector of the NTMF9DA cable assembly are identical. Do not connect a serial device to both access points simultaneously. This will result in incorrect and unpredictable operation of the IP Line card.

## NTAG81CA maintenance cable description

You connect this cable between the 9-pin D-type RS232 input on a standard PC and the MAINT connector on the NT8R17AB faceplate or through the I/O cable serial port.

Figure 37  
NTAG81CA Maintenance cable

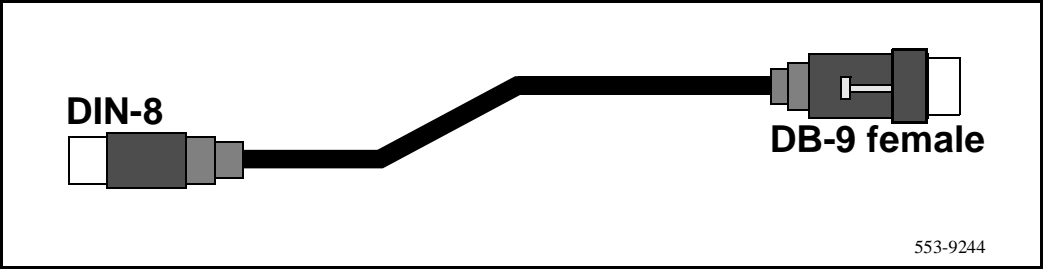


Table 38  
NTAG81CA maintenance cable pin description

| Signals<br>(MIX Side) | 8-pin Mini-DIN<br>(MIX Side)<br>Male | 9-pin D-Sub<br>(PC Side)<br>Female | Signals<br>(PC Side) |
|-----------------------|--------------------------------------|------------------------------------|----------------------|
| DTRB-                 | 1                                    | 6                                  | DSR-                 |
| SOUTB-                | 2                                    | 2                                  | SIN-                 |
| SINB-                 | 3                                    | 3                                  | SOUT-                |
| GND                   | 4                                    | 5                                  | GND                  |
| SINA-                 | 5                                    | nc                                 | nc                   |
| CTSA-                 | 6                                    | nc                                 | nc                   |
| SOUTA-                | 7                                    | nc                                 | nc                   |
| DTRA-                 | 8                                    | nc                                 | nc                   |

## NTAG81BA Maintenance Extender Cable

The 3m cable connects the NTAG81CA cable to a PC or terminal. It has a 9-pin D-type connector at both ends, one male, one female. It can also be used to extend the serial port presented by the NTMF94EA I/O panel cable.

**Figure 38**  
**NTAG81BA Maintenance Extender cable**



**Table 39**  
**NTAG81BA Maintenance cable pin description**

| 9-pin D-Sub (Male) | 9-pin D-Sub (Female) |
|--------------------|----------------------|
| 1                  | 1                    |
| 2                  | 2                    |
| 3                  | 3                    |
| 4                  | 4                    |
| 5                  | 5                    |
| 6                  | 6                    |
| 7                  | 7                    |
| 8                  | 8                    |
| 9                  | 9                    |

## Replace cable NT8D81BA with NT8D81AA

This procedure explains how to replace the NT8D81BA cable with the NT8D81AA cable and how to install the NTCW84JA special IPE filter.

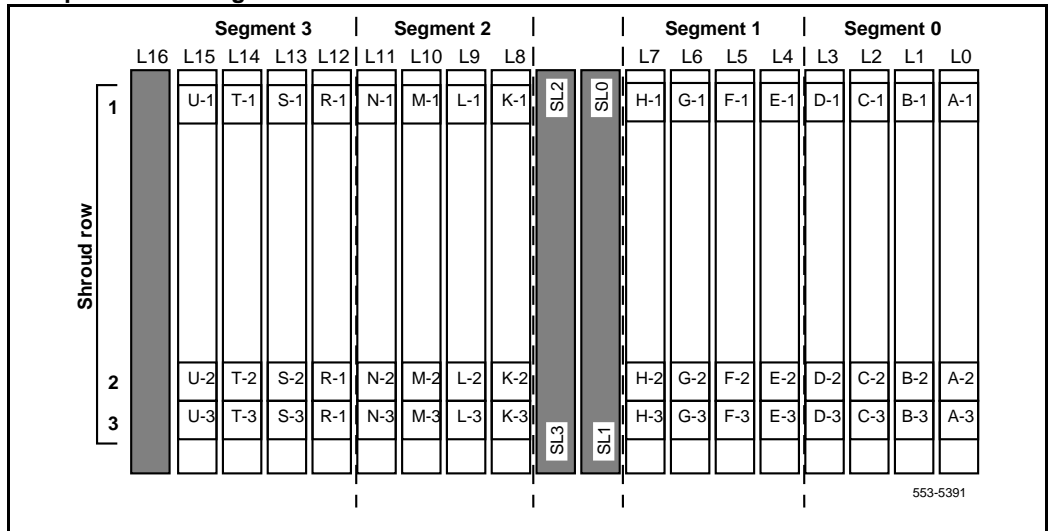
Cables are designated by the letter of the I/O panel cutout, such as A, B, and C, where the 50-pin cable connector is attached. Each cable has three 20-pin connectors (16 positions are used), designated 1, 2, and 3, that attach to the backplane. Using the designations described, the backplane ends of the first cable are referred to as A-1, A-2, and A-3. The locations of the cable connectors on the backplane are designated by the slot number (L0 through L9 for NT8D11, L0 through L15 for NT8D37) and the shroud row (1, 2, and 3). Using these designations, the slot positions in the first slot are referred to as L0-1, L0-2, and L0-3.

In NT8D37BA and NT8D37EC (and later vintage) IPE Modules, all 16 IPE card slots support 24-pair cable connections. Table 40 shows the cable connections from the backplane to the inside of the I/O panel. Figure 39 shows the designations for the backplane end of the cables, the backplane slot designations for the cable connections, and the associated network segments for the backplane slots.

**Table 40**  
**NT8D37 cable connections**

| Backplane slots—shroud rows | I/O panel/cable designation |
|-----------------------------|-----------------------------|
| L0-1, 2, 3                  | A                           |
| L1-1, 2, 3                  | B                           |
| L2-1, 2, 3                  | C                           |
| L3-1, 2, 3                  | D                           |
| L4-1, 2, 3                  | E                           |
| L5-1, 2, 3                  | F                           |
| L6-1, 2, 3                  | G                           |
| L7-1, 2, 3                  | H                           |
| L8-1, 2, 3                  | K                           |
| L9-1, 2, 3                  | L                           |
| L10-1, 2, 3                 | M                           |
| L11-1, 2, 3                 | N                           |
| L12-1, 2, 3                 | R                           |
| L13-1, 2, 3                 | S                           |
| L14-1, 2, 3                 | T                           |
| L15-1, 2, 3                 | U                           |

**Figure 39**  
**Backplane slot designations**



## Tools list

- Ty-wrap cutter
- Ty-wraps
- Needle nose pliers
- Slotted screwdriver

### Procedure 51

#### Removing an NT8D81BA cable

- 1 Identify the I/O panel and backplane designation that corresponds to the LEFT slot of the pair of card slots, viewed front the front, in which you installed the ITG ISL Trunk card.
- 2 Disconnect the filter from the I/O panel using screwdriver and needle nose pliers. Retain the fasteners.
- 3 Power down the IPE shelf.
- 4 Remove the IPE module I/O safety panel.

- 5 To remove the ribbon cables from IPE backplane:  
Apply gentle pressure on the tab on the right side of the shroud while pulling on the connector until it pulls free from the shroud.  
Remove connector 1 first, then remove connectors 2 and 3.
- 6 Discard NT8D81BA cable.

————— *End of Procedure* —————

## **Procedure 52**

### **Installing an NTCW84JA filter and NT8D81AA cable**

- 1 Install NTCW84JA special IPE filter connector in the vacant I/O panel slot using retained hardware.
- 2 Install NT8D81AA ribbon cable connectors in the IPE module backplane shroud. Be sure to install the connector so the label is facing right with the arrow pointing up and the connector is fully engaged into the shroud:
  - a Install connector 1, (labeled UP1^ ) into backplane shroud 1.
  - b Install connector 2, (labeled UP2^ ) into backplane shroud 2.
  - c Install connector 3, (labeled UP3^ ) into backplane shroud 3.
- 3 Dress the ribbon cables back individually inside the rear of IPE module and restore the original arrangement. Start with the cables that are going to be underneath.
- 4 Attach NTCW84JA special IPE filter to NT8D81AA 50-pin connector using bail clips.
- 5 Restore power to the IPE module.
- 6 Replace the I/O safety panel.

————— *End of Procedure* —————

---

## Appendix B: RM356 modem router

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### Contents

This section contains information on the following topics:

|                                                                                                        |     |
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### Overview

Management and support of the ITG network depend on IP networking protocols including SNMP, FTP, and Telnet. Install a modem router on the Meridian 1 site LAN (called the embedded LAN or E-LAN as opposed to the customer's enterprise network or C-LAN) in order to provide remote support access for ITG and other IP-enabled Nortel Networks products.

The Netgear RM356 modem router integrates the functions of a V.90 modem, a PPP remote access server, an IP router, and a 4-port 10BaseT Ethernet hub, and provides a range of security features configured to comply with the customer's data network security policy. Do not install a modem router on the E-LAN without the explicit approval of the customer's IP network manager. The RM356 modem router is not secure unless it is configured correctly according to the customer's network security policy and practices. Figure 40 shows an example of a remote network.

## RM356 modem router security features

- Password Authentication Protocol (PAP) for dial-in PPP connection.
- RM356 manager password.
- CLID for dial-in user authentication (requires C.O. line with Calling Line ID).
- Callback for dial-in user authentication.
- Dial-in user profiles
- Static IP routing
- IP Packet Filtering
- Idle timeout disconnect for dial-in PPP connection.

## Install the RM356 modem router

### Procedure 53

#### Installing the RM356 modem router

- 1 Place the modem router at a conveniently visible and physically secure location near an AC power outlet, an analog telephone line, and a 10BaseT Ethernet cable.

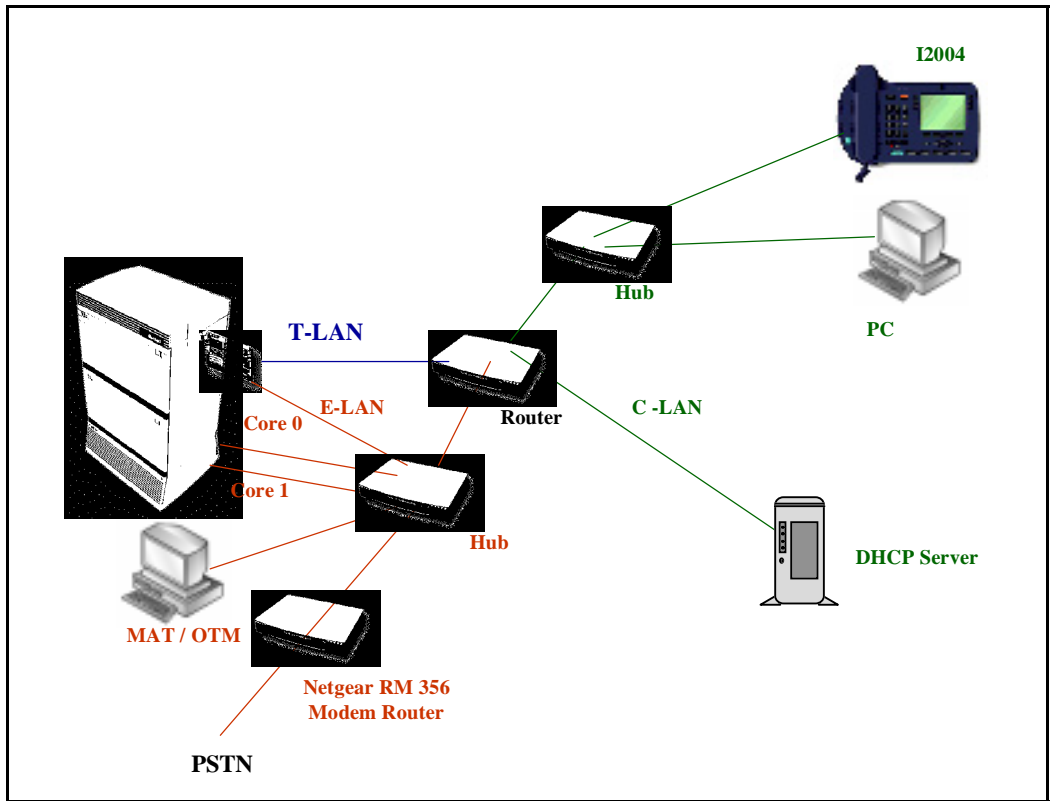
Up to four hosts or hubs can be connected to the integrated 10BaseT hub in the rear of the RM356 modem router.

- 2 Use shielded Cat5 10BaseT Ethernet cables to connect the modem router to the Management interface of up to four ITG cards. Other IP-enabled Nortel Networks products on the E-LAN can be connected to the RM356 modem router, including the Meridian 1 PBX, a local MAT 6.6/OTM 1.0 6.6/OTM 1.0 PC, Symposium Call Center Server, and Call Pilot.

**Note:** The up-link connection to an additional E-LAN hub or optional C-LAN gateway requires either a cross-over 10BaseT Ethernet cable, or a special up-link port on the 10BaseT hub to which the RM356 is connected.



**Figure 40**  
**Remote support using Netgear RM356 modem router**



- 3 Connect the modem router to the AC power source. The power LED will light. After several seconds, the test LED flashes slowly four times, then stays off.

For each of the four 10BaseT ports on the integrated hub there is a link/data LED that is lit steadily to indicate a good received link (if a cable is connected to a host or hub), or flashing, to indicate data received on the LAN.

- 4 Connect the RJ45 plug end of the local manager cable to the RS232 Manager port RJ45 jack on the rear of the modem router.

5 Connect the other end of the manager cable to an RS232 terminal or PC COM port configured for the following communication parameters: 9600 bps, 8, none, and 1.

6 The local maintenance cable connects directly to data terminal equipment (DTE).

**Note:** The analog telephone line must be either a C.O. line or a PBX extension with a Direct Inward Dialing(DID) number, whichever complies with the customer's network security policy.

————— *End of Procedure* —————

## Configure the RM356 modem router by the manager menu

This procedure can be performed from a terminal or PC connected to the local RS232 manager port on the rear of the modem router. Alternatively the manager menu can be accessed by Telnet after the IP addressing and routing have been set up initially from the local manager port.

Use the following keys in the RM356 manager menu:

- The arrow keys to navigate
- The spacebar key to toggle pre-defined configuration values for a field.
- The Enter key saves data changes to ROM and exits the current menu.
- The Esc key exits the current menu without saving changes.
- Enter menu selection number when prompted to display a sub-menu, configuration form, or command prompts.

### Procedure 54

#### Configuring the RM356 modem router

- 1 From the terminal or manager menu, Press the **Enter** key.  
The 'Enter Password:' prompt is displayed for 10 seconds.
- 2 Enter the default RM356 manager password: 1234  
The "RM356 Main Menu" is displayed.
- 3 Enter menu selection number 1 to access "General Setup" under the "Getting Started" section of the "RM356 Main Menu."  
"Menu 1 General Setup" is displayed.

- 4 Type in the system name (19 characters, no spaces), location, and contact person's name for the Meridian 1 site. Use the up and down arrow keys to move the cursor to the prompt **"Press ENTER to Confirm or ESC to Cancel:"** at the bottom of the menu. Press **Enter** to confirm and save data to ROM.
- 5 Enter menu selection number 2 under the "Getting Started" section.  
"Menu 2: Modem" is displayed.
- 6 Type in modem name. Set "Active=Yes". Use arrow keys to navigate and space bar to toggle values. Set "Direction=Incoming". Type in the modem router's telephone number for reference. Press **Enter** to confirm and save data to ROM.
- 7 Enter menu selection number 3, "Ethernet Setup", under the "Getting started" section.  
"Menu 3: Ethernet Setup" sub-menu is displayed.
- 8 Enter menu selection 2, "TCP/IP and DHCP Setup".  
"Menu 3.2 - TCP/IP and DHCP Ethernet Setup" is displayed.
- 9 Use the space bar to toggle "DHCP=None".
- 10 Under "TCP/IP Setup", type in the IP address and the IP Subnet mask for the modem router's Ethernet interface on the E-LAN.
- 11 Toggle "RIP Direction=None". Press **Enter** to confirm and save data to ROM, then press **Esc** to return from the sub-menu to the main menu.
- 12 Enter menu selection number 12, "Static Routing Setup", under the "Advanced Applications" section.  
"Menu 12 - Static Route Setup" sub-menu is displayed.

**Note 1:** If firewall security is properly configured in the customer's Management GW router, and if the modem router is permitted access over the C-LAN to other ITG nodes on remote E-LANs, define a default network route pointing to the Management GW IP address on the local E-LAN. Alternatively, define up to four different static network routes or host routes in the modem router to limit routing access from the modem router to the C-LAN.

**Note 2:** To prevent access from the modem router to the C-LAN via the Management GW router on the E-LAN, disable RIP by setting "RIP Direction=None", and remove all static routes or disable a particular static route by setting "Active=No".

- 13** Type in a descriptive route name, for example, "DefaultGW" (no spaces). Toggle "Active=Yes/No" for security purposes. The gateway IP address is the Management GW IP address on the E-LAN where the modem router is connected. " Press Enter to confirm and save data to ROM, then press Esc to return from the sub-menu to the main menu.
- 14** Enter menu selection number 13, "Default Dial-in Setup", under the "Advanced Applications" section.
- "Menu 13 - Default Dial-in Setup " is displayed.
- 15** Enter menu selection number 1 to edit the first static route.
- "Menu 12.1 - Edit IP Static Route" is displayed.
- 16** Under "Telco Options" toggle "CLIDAuthen=None/Preferred/Required".
- CLID requires a C.O. line subscribed for CLID service where available. "Preferred" means some dial-in user profiles require CLID, but others do not. "Required" means no dial-in call is connected unless CLID is provided and user profiles require CLID for authentication.
- Under "PPP Options" toggle "Recv Authen=PAP". Windows 9x Dial-up Networking (DUN) is not compatible with CHAP/PAP or CHAP on the modem router: calls are disconnected after a few minutes.
- Toggle "Compression=No". Windows 9x DUN is not compatible with software compression on the modem router: calls are randomly disconnected.
- Toggle "Mutual Authen=No".
- Under "IP Address Supplied By:" Toggle "Dial-in User=No", "IP Pool=Yes". For "IP Start Addr=" type in the E-LAN IP address that will be assigned to the Dial-up Networking (DUN) PPP client on the remote MAT 6.6/OTM 1.0 PC.
- Note:** The remote MAT/OTM PC receives this E-LAN IP address whenever DUN makes a dial-in PPP connection to the modem router. As long as DUN remains connected to the modem router, IP applications on the remote MAT 6.6/OTM 1.0 PC function as if the PC were located on the customer's E-LAN.
- Under "Session Options" configure input and output filter sets according to the customer's IP network security policy and practices. The default setting is no filter sets. Set "Idle Timeout=1200" seconds

to provide 20 minutes idle timeout disconnect for remote support purposes. Press Enter to confirm and save data to ROM.

- 17** Enter menu selection number 14, "Dial-in User Setup", under the "Advanced Applications" section.

"Menu 14 - Dial-in User Setup " is displayed.

**Note:** Up to eight dial-in user profiles can be defined according to the customer's network security policy.

- 18** Enter menu selection 1 to edit the first dial-in user profile.

"Menu 14.1 - Edit Dial-in User" is displayed.

- 19** Type in the user name. Toggle "Active=Yes/No" for security purposes. Type in a password for PAP. The DUN client on the remote MAT 6.6/OTM 1.0 PC must provide the user name and password defined here when dialing up the modem router.

Set "Callback=Yes/No" according to the customer's network security policy and practices. Nortel Networks Customer Technical Services (CTS), does not currently accept Callback security calls from the modem router.

Set "Rem CLID=" to the PSTN Calling Number that is displayed when the remote MAT 6.6/OTM 1.0 PC dials up the modem router, if CLID authentication is required for the user profile. CLID depends on providing a C.O. line subscribed for CLID service for the modem router's telephone line connection.

Set "Idle Timeout=1200" seconds to provide 20 minutes idle timeout disconnect for Nortel Networks remote support purposes.

Press Enter to confirm and save data to ROM, then press Esc to return from the sub-menu to the main menu.

- 20** Enter menu selection number 23 to access "System Password" under the "Advanced Management" section of the "RM356 Main Menu."

"Menu 23 - System Password" is displayed.

- 21** Type in the old password and new password, then retype the new password to confirm. Never leave the RM356 system manager password defaulted to 1234 after the modem router has been installed and configured on the E-LAN. The modem router's security features are worthless if the manager password is not changed regularly according to good network security practices.

————— *End of Procedure* —————

## RM356 modem router manager menu description (application notes on Meridian 1 E-LAN installation)

This section displays the various menus of the RM356 modem router:

### RM356 Main Menu

#### Getting Started

1. General Setup
2. MODEM Setup
3. Ethernet Setup
4. Internet Access Setup

#### Advanced Management

21. Filter Set Configuration
23. System Password
24. System Maintenance

#### Advanced Applications

11. Remote Node Setup
12. Static Routing Setup
13. Default Dial-in Setup
14. Dial-in User Setup
99. Exit

Enter Menu Selection Number:

### Menu 1 - General Setup

System Name= Room\_304\_RCH\_Training\_Center  
Location= Sherman Ave., Richardson, TX  
Contact Person's Name= John Smith, 972 555-1212

Press ENTER to Confirm or ESC to Cancel:

### Menu 2 - MODEM Setup

Modem Name= MODEM  
Active= Yes  
Direction= Incoming  
Phone Number=

Advanced Setup= No  
Press ENTER to Confirm or ESC to Cancel:

Menu 3 - Ethernet Setup

1. General Setup
2. TCP/IP and DHCP Setup

Enter Menu Selection Number:

Menu 3.1 - General Ethernet Setup

Input Filter Sets= 2  
Output Filter Sets=

Press ENTER to Confirm or ESC to Cancel:

Menu 3.2 - TCP/IP and DHCP Ethernet Setup

DHCP Setup:

DHCP= None  
Client IP Pool Starting Address= N/A  
Size of Client IP Pool= N/A  
Primary DNS Server= N/A  
Secondary DNS Server= N/A

TCP/IP Setup:

IP Address= 47.177.16.254  
IP Subnet Mask= 255.255.255.0  
RIP Direction= None  
Version= RIP-2B

Press ENTER to Confirm or ESC to Cancel:

Press Space Bar to Toggle.

Menu 12 - Static Route Setup

1. DefaultGW
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_

Enter Menu Selection Number:

Menu 12.1 - Edit IP Static Route

Route #: 1  
Route Name= DefaultGW  
Active= Yes  
Destination IP Address= 0.0.0.0  
IP Subnet Mask= 0.0.0.0  
Gateway IP Address= 47.177.16.1  
Metric= 2  
Private= No

Press ENTER to Confirm or ESC to Cancel:

Menu 13 - Default Dial-in Setup

|                   |                              |
|-------------------|------------------------------|
| Telco Options:    | IP Address Supplied By:      |
| CLID Authen= None | Dial-in User= No             |
|                   | IP Pool= Yes                 |
| PPP Options:      | IP Start Addr= 47.177.16.253 |
| Recv Authen= PAP  |                              |
| Compression= No   | Session Options:             |
| Mutual Authen= No | Input Filter Sets=           |
| PAP Login= N/A    | Output Filter Sets=          |
| PAP Password= N/A | Idle Timeout= 1200           |

Callback Budget Management:



Allocated Budget(min)=  
Period(hr)=

Press ENTER to Confirm or ESC to Cancel:

Press Space Bar to Toggle.

Menu 14 - Dial-in User Setup

1. itgadmin
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_

Enter Menu Selection Number:

Menu 14.1 - Edit Dial-in User

User Name= itgadmin  
Active= Yes  
Password= \*\*\*\*\*  
Callback= No  
    Phone # Supplied by Caller= N/A  
    Callback Phone #= N/A  
Rem CLID=  
Idle Timeout= 500

Press ENTER to Confirm or ESC to Cancel:

Menu 21 - Filter Set Configuration

| Filter Set # | Comments    | Filter Set # | Comments |
|--------------|-------------|--------------|----------|
| 1            | NetBEUI_WAN | 7            |          |
| 2            | NetBEUI_LAN | 8            |          |
| 3            |             | 9            |          |
| 4            |             | 10           |          |
| 5            |             | 11           |          |
| 6            |             | 12           |          |

Enter Filter Set Number to Configure= 0

Edit Comments=

Press ENTER to Confirm or ESC to Cancel:

Menu 21.1 - Filter Rules Summary

| # | A | Type | Filter Rules                          | M | m | n |
|---|---|------|---------------------------------------|---|---|---|
| 1 | Y | IP   | Pr=17, SA=0.0.0.0, SP=137, DA=0.0.0.0 | N | D | N |
| 2 | Y | IP   | Pr=17, SA=0.0.0.0, SP=138, DA=0.0.0.0 | N | D | N |
| 3 | Y | IP   | Pr=17, SA=0.0.0.0, SP=139, DA=0.0.0.0 | N | D | N |
| 4 | Y | IP   | Pr=6, SA=0.0.0.0, SP=137, DA=0.0.0.0  | N | D | N |
| 5 | Y | IP   | Pr=6, SA=0.0.0.0, SP=138, DA=0.0.0.0  | N | D | N |
| 6 | Y | IP   | Pr=6, SA=0.0.0.0, SP=139, DA=0.0.0.0  | N | D | F |

Enter Filter Rule Number (1-6) to Configure:

Menu 23 - System Password

Old Password= ?

New Password= ?  
Retype to confirm= ?

Enter here to CONFIRM or ESC to CANCEL:

Menu 24 - System Maintenance

1. System Status
2. Terminal Baud Rate
3. Log and Trace
4. Diagnostic
5. Backup Configuration
6. Restore Configuration
7. Software Update
8. Command Interpreter Mode
9. Call Control

Enter Menu Selection Number:

Menu 24.1 -- System Maintenance - Status

| Port | Status | Speed | TXPkts | RXPkts | Errs | Tx B/s | Rx B/s | Up Time |
|------|--------|-------|--------|--------|------|--------|--------|---------|
| 1    | Idle   | 0Kbps | 16206  | 12790  | 0    | 0      | 0      | 0:00:00 |

Total Outcall Time: 0:00:00

Ethernet: Name: Room\_304\_RCH\_Traini  
Status: 10M/Half Duplex RAS S/W Version: V2.13 | 9/25/98  
TX Pkts: 135579 Ethernet Address:00:a0:c5:e0:5b:a6  
RX Pkts: 662866  
Collisions: 49

LAN Packet Which Triggered Last Call:

Press Command:

COMMANDS: 1-Drop Port 1 9-Reset Counters ESC-Exit  
Menu 24.2 -- System Maintenance - Change Terminal Baud Rate

Terminal Baud Rate: 9600

Press ENTER to Confirm or ESC to Cancel:

Press Space Bar to Toggle.

Menu 24.3 == System Maintenance - Log and Trace

1. View Error Log
2. Syslog and Accounting

Please enter selection:

|    |        |      |      |                   |
|----|--------|------|------|-------------------|
| 0  | 179754 | PINI | INFO | SMT Session End   |
| 1  | 179761 | PP09 | INFO | Password pass     |
| 2  | 179761 | PINI | INFO | SMT Session Begin |
| 3  | 179763 | PINI | INFO | SMT Session End   |
| 4  | 179772 | PP09 | INFO | Password pass     |
| 5  | 179772 | PINI | INFO | SMT Session Begin |
| 6  | 179775 | PINI | INFO | SMT Session End   |
| 7  | 179783 | PP09 | INFO | Password pass     |
| 8  | 179783 | PINI | INFO | SMT Session Begin |
| 9  | 179788 | PINI | INFO | SMT Session End   |
| 10 | 179796 | PP09 | INFO | Password pass     |
| 11 | 179796 | PINI | INFO | SMT Session Begin |
| 12 | 179798 | PINI | INFO | SMT Session End   |
| 13 | 179812 | PP09 | INFO | Password pass     |
| 14 | 179812 | PINI | INFO | SMT Session Begin |
| 15 | 179815 | PINI | INFO | SMT Session End   |
| 16 | 179830 | PP09 | INFO | Password pass     |
| 17 | 179830 | PINI | INFO | SMT Session Begin |
| 18 | 179834 | PINI | INFO | SMT Session End   |

Menu 24.3.2 -- System Maintenance - Syslog and Accounting

Syslog:  
Active= No  
Syslog IP Address= ?  
Log Facility= Local 1

Press ENTER to Confirm or ESC to Cancel:

Press Space Bar to Toggle.

Menu 24.4 - System Maintenance - Diagnostic

| MODEM                | System            |
|----------------------|-------------------|
| 1. Drop MODEM        | 21. Reboot System |
| 2. Reset MODEM       | 22. Command Mode  |
| 3. Manual Call       |                   |
| 4. Redirect to MODEM |                   |

TCP/IP

- 11. Internet Setup Test
- 12. Ping Host

Enter Menu Selection Number:

Manual Call Remote Node= N/A  
Host IP Address= N/A

Menu 24.7 -- System Maintenance - Upload Firmware

- 1. Load RAS Code
- 2. Load ROM File

Enter Menu Selection Number: 1



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# Appendix C: Product integrity

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## Contents

This section contains information on the following topics:

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| Mean time between failures (MTBF) ..... | 263 |
| Environmental specifications .....      | 263 |
| Temperature-related conditions .....    | 264 |
| Electrical regulatory standards .....   | 265 |

This chapter presents information about the Meridian Internet Telephony Gateway (ITG) Line 2.0 card reliability, environmental specifications, and electrical regulatory standards.

## Reliability

Reliability is measured by the Mean Time Between Failures (MTBF).

### Mean time between failures (MTBF)

The ITG Line 2.0 card Mean Time Between Failure (MTBF) is 46 years. Failures per  $10^6$  hours of operation are 2.483, based on 40 degrees C (140 degrees F).

## Environmental specifications

Measurements of performance in regards to temperature and shock were made under test conditions as described in the following table.

Temperature-related conditions

Refer to Table 41 for a display of acceptable temperature and humidity ranges for the ITG Line 2.0 card.

Table 41  
ITG Line 2.0 card environmental specifications

| Specification                | Minimum                         | Maximum              |
|------------------------------|---------------------------------|----------------------|
| Normal Operation             |                                 |                      |
| Recommended                  | 15° C                           | 30° C                |
| Relative humidity            | 20%                             | 55% (non-condensing) |
| Absolute                     | 10 ° C                          | 45° C                |
| Relative humidity            | 20% to                          | 80% (non-condensing) |
| Short Term (less than 72 hr) | −40° C                          | 70° C                |
| Rate of change               | Less than 1° C per 3 minutes    |                      |
| Storage                      |                                 |                      |
| Recommended                  | −20° C                          | 60° C                |
| Relative Humidity            | 5%                              | 95% (non-condensing) |
|                              | −40° C to 70° C, non-condensing |                      |
| Temperature Shock            |                                 |                      |
| In 3 minutes                 | −40° C                          | 25° C                |
| In 3 minutes                 | 70° C                           | 25° C                |
|                              | -40° to 70° C, non-condensing   |                      |



## Electrical regulatory standards

The following three tables list the safety and electro-magnetic compatibility regulatory standards for the ITG Line 2.0 card, listed by geographic region. Specifications for the ITG Line 2.0 card meet or exceed the standards listed in these regulations.

### Safety

Table 42 provides a list of safety regulations met by the ITG Line 2.0 card, along with the type of regulation and the country/region covered by each regulation.

**Table 42**  
**Safety regulations**

| Regulation Identifier        | Regulatory Agency             |
|------------------------------|-------------------------------|
| UL 1459                      | Safety, United States, CALA   |
| CSA 22.2 225                 | Safety, Canada                |
| EN 41003                     | Safety, International Telecom |
| EN 60950/IEC 950             | Safety, International         |
| BAKOM SR 784.103.12/4.1/1    | EMC/Safety (Switzerland)      |
| AS3260, TS001 - TS004, TS006 | Safety/Network (Australia)    |
| JATE                         | Safety/Network (Japan)        |

**Electro-magnetic compatibility (EMC)**

Table 43 lists Electro-magnetic emissions regulations met by the ITG Line 2.0 card, along with the country’s standard that lists each regulation.

**Table 43**  
**Electro-Magnetic Emissions**

| Regulation Identifier     | Regulatory Agency                            |
|---------------------------|----------------------------------------------|
| FCC part 15 Class A       | United States Radiated Emissions             |
| CSA C108.8                | Canada Radiated Emissions                    |
| EN50081-1                 | European Community Generic Emission Standard |
| EN55022/CISPR 22 CLASS B  | Radiated Emissions (Basic Std.)              |
| BAKOM SR 784.103.12/4.1/1 | EMC/Safety (Switzerland)                     |
| SS-447-20-22              | Sweden EMC standard                          |
| AS/NZS 3548               | EMC (Australia/New Zealand)                  |
| NFC 98020                 | France EMC standard                          |

Table 44 lists Electro-magnetic immunity regulations met by the ITG Line 2.0 card, along with the country's standard that lists each regulation.

**Table 44**  
**Electro-Magnetic Immunity**

| Regulation Identifier            | Regulatory Agency                              |
|----------------------------------|------------------------------------------------|
| CISPR 22 Sec. 20 Class B         | I/O conducted noise                            |
| IEC 801-2 (level 4)              | ESD (Basic Standard)                           |
| IEC 801-3 (level 2)              | Radiated Immunity (Basic Standard)             |
| IEC 801-4 (level 3)              | Fast transient/Burst Immunity (Basic Standard) |
| IEC 801-5 (level 4, preliminary) | Surge Immunity (Basic Standard)                |
| IEC 801-6 (preliminary)          | Conducted Disturbances (Basic Standard)        |
| BAKOM SR 784.103.12/4.1/1        | EMC/Safety (Switzerland)                       |
| SS-447-20-22                     | Sweden EMC standard                            |
| AS/NZS 3548                      | EMC (Australia/New Zealand)                    |
| NFC 98020                        | France EMC standard                            |



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## Appendix D: Subnet mask conversion from CIDR to dotted decimal format

---

Subnet masks are expressed in Classless Inter Domain Routing (CIDR) format, appended to the IP address. For example 10.1.1.1/20. The subnet mask must be converted from CIDR format to dotted decimal format in order to configure IP addresses.

The CIDR format expresses the subnet mask as the number of bits counting from the most significant bit of the first IP address field. A complete IP address consists of 32 bits. Therefore, a typical CIDR format subnet mask will be in the range from /9 to /30. Each decimal number field in the dotted decimal format has a value from 0 to 255, where decimal 255 represents binary 1111 1111.

### Convert subnet mask from CIDR format to dotted decimal format

- 1 Divide the CIDR format value by 8. The quotient (the number of times that eight divides into the CIDR format value) equals the number of dotted decimal fields containing 255.

In the example above, the subnet mask is expressed as /20. Twenty divided by eight equals a quotient of two, with a remainder of four. Therefore, the first two fields of the subnet mask in dotted decimal format are 255.255.

- 2 If there is a remainder, refer to Table 45, to obtain the dotted decimal value for the field following the last field containing “255”. In the example of /20 above, the remainder is four. In Table 45, a remainder of four equals a binary value of 1111 0000 and the dotted decimal value of the next and last field is 240. Therefore the first three fields of the subnet mask are 255.255.240.
- 3 If there are any remaining fields in the dotted decimal format, they have a value of 0. Therefore, the complete subnet mask in dotted decimal format is 255.255.240.0.

**Table 45**  
**CIDR format remainders**

| Remainder of CIDR format<br>value divided by eight | Binary value | Dotted decimal value |
|----------------------------------------------------|--------------|----------------------|
| 1                                                  | 1000 0000    | 128                  |
| 2                                                  | 1100 0000    | 192                  |
| 3                                                  | 1110 0000    | 224                  |
| 4                                                  | 1111 0000    | 240                  |
| 5                                                  | 1111 1000    | 248                  |
| 6                                                  | 1111 1100    | 252                  |
| 7                                                  | 1111 1110    | 254                  |

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## Appendix E: ITG System Messages

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### Contents

This section contains information on the following topics:

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### ITG messages

ITG and ITS messages incorporate the severity category of the message in the first digit of the four digit number. Message numbers beginning with 0 do not follow this format.

where:

- 1 = Critical
- 2 = Major
- 3 = Minor
- 4 = Warning
- 5 = Cleared (Info)
- 6 = Indeterminate (Info)

All ITG and ITS error messages with a severity category of "Critical", are also displayed on the ITG Line 2.0 card faceplate. Refer to "Faceplate maintenance display codes" on page 206 for further information.

|         |                                                             |
|---------|-------------------------------------------------------------|
| ITG0100 | Successful bootstrap. All alarms cleared.                   |
| ITG0101 | Exit from QoS fallback. Normal operation restored.          |
| ITG0102 | Ethernet voice port restored to normal operation.           |
| ITG0103 | Ethernet management port restored to normal operation.      |
| ITG0104 | DSP successfully reset.                                     |
| ITG0105 | Exit from card fallback. Leader card restored.              |
| ITG0150 | D-channel restored. Channels restored to service.           |
| ITG0200 | Voice Ethernet buffer exceeded. Packet(s) discarded.        |
| ITG0201 | Management Ethernet buffer exceeded. Packet(s) discarded.   |
| ITG0202 | Card recovered from software reboot.                        |
| ITG0203 | Fallback to PSTN activated.                                 |
| ITG0204 | DSP device reset.                                           |
| ITG0206 | Invalid A07 message received. Message discarded.            |
| ITG0207 | Unknown H.323 message received. Message discarded/rejected. |
| ITG0208 | Backup leader has been activated.                           |
| ITG0250 | Invalid X12 message received. Message discarded.            |
| ITG0300 | Memory allocation failure.                                  |
| ITG0301 | Channel not responding. Channel is disabled.                |
| ITG0302 | DSP device failure. Operating on reduced capacity.          |
| ITG0303 | DSP subsystem failure. Initiating card reboot.              |
| ITG0304 | Cannot write to file I/O write error.                       |
| ITG0305 | Cannot open configuration file. Using default settings.     |
| ITG0306 | Meridian Messaging error threshold exceeded.                |
| ITG0308 | Address Translation failure. Call is released.              |



---

|          |                                                                          |
|----------|--------------------------------------------------------------------------|
| ITG0309  | Unexpected DSP channel closed. Channel is unusable.                      |
| ITG0310  | Cannot open DSP channel.                                                 |
| ITG0311  | Unable to get response from Follower card.                               |
| ITG0312  | Unable to push BOOTP tab file to backup leader.                          |
| ITG0313  | Keycode failed validation. Configuration file discarded.                 |
| ITG0350  | Gatekeeper RAS reject threshold exceeded.                                |
| ITG0351  | Cannot open Gatekeeper configuration file. Using default settings.       |
| ITG0400  | Fatal self-test failure. Card is out of service.                         |
| ITG0401  | Reboot threshold exceeded. Manual intervention required.                 |
| ITG0402  | Ethernet voice port failure.                                             |
| ITG0403  | Ethernet management port failure.                                        |
| ITG0404  | Can't open address translation file.                                     |
| ITG0405  | Keycode file failed validation during bootup.                            |
| ITG0406  | Start-up memory allocation failure. Card reboot initiated.               |
| ITG0407  | Unable to get response from leader card.                                 |
| ITG0408  | Bad address translation file. Reverting to previous version (if any).    |
| ITG0409  | Bad configuration file. Reverting to previous version (if any).          |
| ITG0410  | Remote leader not responding.                                            |
| ITG0411  | Failed to start UDP server for intercard messaging. Card is in fallback. |
| ITG0412  | Failed to start UDP client for intercard messaging. Card is in fallback. |
| ITG0413  | Failed to register with Leader card. Defaulting to fallback mode.        |
| ITG0414  | No response from Leader card.                                            |
| ITG0415  | Task spawn failed. Attempting a reboot.                                  |
| IITG0416 | Failed to start QOS/Network Probing Timer.                               |

|          |                                                                               |
|----------|-------------------------------------------------------------------------------|
| ITG0417  | Update to followers.                                                          |
| ITG0418  | H-323 stack failed to initialize.                                             |
| ITG0450  | D-channel loss of signal. Associated channels busied out.                     |
| ITG0451  | D-channel hardware failure. Associated channels busied out.                   |
| ITG0452  | Meridian -1 messaging failure. Unable to process calls.                       |
| ITG0453  | Cannot open Gateway DN file.                                                  |
| ITG0454  | Cannot open Gatekeeper password file.                                         |
| ITG0455  | Bad Gatekeeper configuration file. Reverting to previous version if any.      |
| ITG0456  | Incorrect Gateway password. Calls to/from Gateway rejected by the Gatekeeper. |
| ITGx000  | Card (re)booted,<br>where x = 1-6                                             |
| ITGx001  | Task spawn failure <name>.<br>where x = 1-6                                   |
| ITGx002  | Memory allocation failure.<br>where x = 1-6                                   |
| ITGx003  | File IO error <operation> <object> <errno> <errtext>.<br>where x = 1-6        |
| ITGx004  | Network IO error <operation> <object> <errno> <errtext>.<br>where x = 1-6     |
| ITGx005  | Message queue error <operation> <object> <errno> <errtext>.<br>where x = 1-6  |
| ITGx006  | Unexpected state encountered <file> <line> <state>.<br>where x = 1-6          |
| IITGx007 | Unexpected message type <file> <line> <msg>.<br>where x = 1-6                 |
| ITGx008  | Null pointer encountered <file> <line> Name of pointer.                       |

|         |                                                                                        |
|---------|----------------------------------------------------------------------------------------|
|         | where x = 1-6                                                                          |
| ITGx009 | Invalid block <file> <line> Type of block.<br>where x = 1-6                            |
| ITGx010 | Unable to locate data block <file> <line> Type of block.<br>where x = 1-6              |
| ITGx011 | Failed to push file <file> <host>.<br>where x = 1-6                                    |
| ITGx012 | Failed to retrieve file <file> <host>.<br>where x = 1-6                                |
| ITGx013 | Voice ethernet receive buffer unavailable, packet(s) discarded.<br>where x = 1-6       |
| ITGx014 | Management ethernet receive buffer unavailable, packet(s), discarded.<br>where x = 1-6 |
| ITGx015 | Voice ethernet device failure.<br>where x = 1-6                                        |
| ITGx016 | Management ethernet device failure.<br>where x = 1-6                                   |
| ITGx017 | Invalid or unknown A07 SSD message <tn> <msg>.<br>where x = 1-6                        |
| ITGx018 | Invalid or unknown X12 SSD message <tn> <msg>.<br>where x = 1-6                        |
| ITGx019 | DSP channel open failure <channel>.<br>where x = 1-6                                   |
| ITGx020 | Configuration error <param> <value> <reason>.<br>where x = 1-6                         |
| ITGx021 | DSP successfully reset <dsp>.<br>where x = 1-6                                         |

|         |                                                                            |
|---------|----------------------------------------------------------------------------|
| ITGx022 | DSP channel not responding, channel disabled <channel>.<br>where x = 1-6   |
| ITGx023 | DSP device failure, operating at reduced capacity <dsp>.<br>where x = 1-6  |
| ITGx024 | DSP failure <dsp> <errno> <errtext>.<br>where x = 1-6                      |
| ITGx025 | DSP download failed retrying <dsp>.<br>where x = 1-6                       |
| ITGx026 | DSP download retry succeeded <dsp>.<br>where x = 1-                        |
| ITGx027 | DSP memory test timed out <dsp>.<br>where x = 1-6                          |
| ITGx028 | DSP memory test failed <dsp>.<br>where x = 1-6                             |
| ITGx029 | Error in DSP task <file> <line> <errno> <errtext>.<br>where x = 1-6        |
| ITGx030 | Channel registration failure <channel> <errno> <errtext>.<br>where x = 1-6 |
| ITGx031 | Allocation failure in DSP memory pool.<br>where x = 1-6                    |
| ITGx032 | Invalid codec number <codec>.<br>where x = 1-6                             |
| ITGx033 | Duplicate open attempt on channel <channel>.<br>where x = 1-6              |
| ITGx034 | DSP channel send failure <channel>.<br>where x = 1-6                       |
| ITGx035 | Channel unexpectedly closed <channel>.                                     |

where x = 1-6

ITGx036      Encountered unexpected open channel, closed it <channel>.

where x = 1-6

## ITS messages

ITS messages incorporate the severity category of the message in the first digit of the four digit number.

ITSx000      VTI function call timeout.

where x = 1-6

ITSx001      User terminal registration failed. <ip> <hwid> <errno> <errtext>.

where x = 1-6

ITSx002      Connect service activation error <reason>.

where x = 1-6

ITSx003      Duplicate master <node> <ip1> <ip2>.

where x = 1-6

ITSx004      Failed to retrieve node ID and TN <ip> <hwid>

where x = 1-6

ITSx005      Invalid node ID <ip> <hwid>.

where x = 1-6

ITSx006      Corrupted node ID/TN field <ip> <hwid>.

where x = 1-6

ITSx007      Received corrupted UNISlim message <message dump>.

where x = 1-6

ITSx008      Received unknown UNISlim message <message dump>.

where x = 1-6

ITSx009      RUDP connection lost: <ip>.

where x = 1-6

ITSx010      RUDP connection restarted: <ip>.

where x = 1-6

ITSx011            Communication link to M1 is down.

where x = 1-6

ITSx012            Communication link to M1 is up.

where x = 1-6

## SCH messages

SCH1360            On the M3903 M3904 M3905 and i2004 sets key 17 is reserved for the TRN mnemonic. No other mnemonic except NUL can be configured on that key.

SCH1361            On the M3903 M3904 M3905 and i2004 sets key 18 is reserved for the AO3 or AO6 mnemonic. No other mnemonic except NUL can be configured on that key. Info 9/17/98 0:00:00

SCH1362            On the M3903 M3904 M3905 and i2004 sets key 19 is reserved for the CFW mnemonic. No other mnemonic except NUL can be configured on that key.

SCH1363            On the M3903 M3904 M3905 and i2004 sets key 20 is reserved for the RGA mnemonic. No other mnemonic except NUL can be configured on that key.

SCH1364            On the M3903 M3904 M3905 and i2004 sets key 21 is reserved for PRK mnemonic. No other mnemonic except NUL can be configured on that key.

SCH1365            On the M3903 M3904 M3905 and i2004 sets key 22 is reserved for the RNP mnemonic. No other mnemonic except NUL can be configured on that key.

SCH1366            On the M3903 M3904 M3905 and i2004 sets key 23 is reserved for SCU/SCC/SSU or SSC. No other mnemonic except NUL can be configured on that key.

SCH1367            On the M3903 M3904 M3905 and i2004 sets key 24 is reserved for the PRS mnemonic. No other mnemonic except NUL can be configured on that key.

SCH1368            On the M3903 M3904 M3905 and i2004 sets key 25 is reserved for the CHG mnemonic. No other mnemonic except NUL can be configured on that key.

SCH1369            On the M3903 M3904 M3905 and i2004 sets key 26 is reserved for the CPN mnemonic. No other mnemonic except NUL can be configured on that key.

SCH1966            I2004 sets have to be defined on virtual superloops. Info 7/21/99 0:00:00

SCH1967            I2004 unit type only is allowed on virtual superloops.

- SCH1968      Key 0 must be a DN key on an i2004 set (I.e. one of SCR SCN MCR MCN PLN PLR ACD DN).
- SCH1970      Message Waiting Key (MWK) must be defined on key 16 on an i2004 set.





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# Appendix F: DHCP Supplementary Information

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## Contents

This section contains information on the following topics:

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## Introduction to DHCP

In order to understand how the i2004 Internet Telephone acquires the needed network configuration parameters automatically, the following section briefly describes the Dynamic Host Configuration Protocol (DHCP) protocol. It is recommended that readers, unfamiliar with the subject, read this section. Topics discussed will be helpful for the configuration and future maintenance of the DHCP server and ensure correct implementation with the i2004 Internet Telephone.

DHCP is an extension of BootP. Like BootP, it operates on the client-server model. Unlike BootP, DHCP has more message types. DHCP allows the dynamic allocation of IP addresses to different clients. It can be used to configure clients by supplying the network configuration parameters such as gateway or router IP addresses.

In addition, DHCP has a lease system that controls the duration an IP address is leased to a client. The client can request a specific lease length, or the administrator can determine the maximum lease length. A lease can range from one minute to 99 years. When the lease is up or released by the client the DHCP server automatically retrieves it and reassigns it to other clients if necessary. This is an efficient and accurate way to configure clients on the fly, saving the administrator from an otherwise repetitive task. In doing so, IP addresses can be shared among clients that do not require permanent IP addresses.

## DHCP messages

There are seven different DHCP messages. Each message relates certain information between the client and server (see Table 2).

**Table 46**  
**DHCP message types**

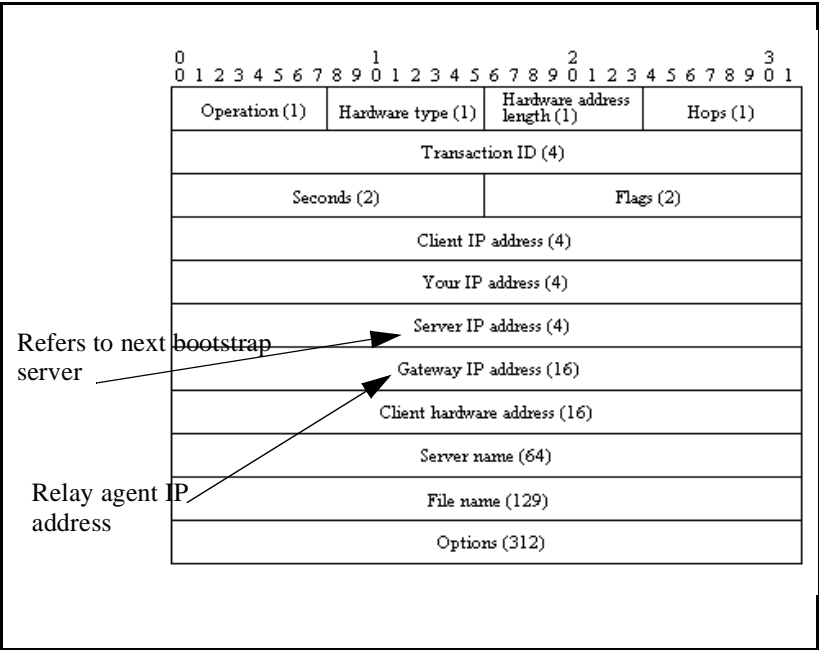
| DHCP Message Types | Description                                                          |
|--------------------|----------------------------------------------------------------------|
| DHCPDISCOVER       | Initiates a client request to all servers.                           |
| DHCPOFFER          | Offer from server following client request.                          |
| DHCPREQUEST        | Request a particular server for services.                            |
| DHCPACK            | Notify client that requested parameters could be met.                |
| DHCPNAK            | Notify client that requested parameters could not be met.            |
| DHCPDECLINE        | Notify server that offer is unsatisfactory and will not be accepted. |
| DHCPRELEASE        | Notify server that IP address is no longer needed.                   |

## DHCP Message Format

The DHCP message format shown in Figure 41 is common to all DHCP messages. Each message is made of 15 fields, 14 fixed-length fields and one variable length field. The fixed-length fields must be the specified number of bytes as indicated in the brackets. If there is not enough data, or there is no data at all, zeros are used to fill in the extra spaces.

The Options field is the only field with a variable length. It is optional, but very important as it transports additional network configuration parameters. The DHCP options are the actual subfields that are used in this project.

**Figure 41**  
**DHCP message format**



**DHCP Message Exchange**

For a client to receive services from a DHCP server, an exchange of DHCP messages between the client and server must take place. The sequence and types of DHCP message exchanged can differ, but the mechanism of acquiring and supplying information remains the same.

Usually the client initiates the exchange with a DHCP message broadcast. Using a broadcast allows the client to send messages to all the servers on the network without having an associated IP address. The broadcast is local to the LAN unless a DHCP relay agent is present to forward the packet.

At this point, the client has no information about the server or the IP address it is going to receive (unless it is requesting a renewal), so the fields in the DHCP message are empty. However, the client knows its own MAC address and includes it in the Client hardware address field. The client may also have a list of parameters it would like to acquire and can request them from the DHCP server by including the Parameter Request List option (Option Code 55) in the DHCPDISCOVER message.

When the DHCP server sees the broadcast, it responds by broadcasting its own DHCP message. The server, since it knows more about the network, is able to fill in most of the information in the message. For example, information such as server IP address and gateway IP address are included in their respective fields. Since the client does not have an IP address yet, the server uses the client's MAC address to uniquely identify it. When the client sees the broadcast, it matches its MAC address against the one in the message.

Using this method, the server and client can supply or receive information through the exchange of their DHCP messages.

## DHCP Options

DHCP Options are the sub fields of the Options field. They carry additional network configuration information requested by the client such as IP address lease length and subnet mask.

Each DHCP option has an associated option code and a format for carrying data. Usually the format is as follows:

Option code Length Data

There are two categories of DHCP options, standard and non-standard. The standard options are predefined by the industry while non-standard options are user-defined to fit the needs of a particular vendor or site.

There are a total of 255 DHCP option codes where option codes 0 and 255 are reserved, 1-77 are predefined, 1-254 can be used for Vendor Specific options and 128-254 are designated for Site Specific options. This arrangement allows for future expansion and is to be used as a guideline for choosing option codes.

## **Vendor Specific/Encapsulated Option**

The Vendor Specific DHCP options are vendor-defined options for carrying vendor-related information. It is possible to override predefined standard options but doing so can cause conflict when used with components that follow the industry standard.

A useful option is the standard Vendor Encapsulated option - code 43. It is used to encapsulate other DHCP options as sub-options. For example, Nortel Network's i2004 Internet Telephone requires vendor specific ITG Line 2.0 card information. The vendor, Nortel Networks, decided to carry this information in one of several Site Specific options and then encapsulate it into option 43. Since the information is specific to a Nortel Networks product, it is vendor specific. Once encapsulated, the information appears as one or more sub options inside option 43, which the i2004 Internet Telephone decodes.

## **Site Specific Option**

Another way to transport the ITG Line 2.0 card information is through Site Specific options. These are unused DHCP options that have not been predefined to carry standard information. Unlike the Vendor Specific options, the information transported is "site" specific and option codes 128-254 are used for encoding.

For Nortel Network's i2004 Internet Telephone, ITG Line 2.0 card information involves the location of the ITG Line 2.0 card in the network. This varies for different sites and can be implemented in a Site Specific option. If the Vendor Encapsulation option is used, the information will have to first be encoded in a Site Specific option. Nortel Networks has provided a list of five possible Site Specific option codes to implement the ITG Line 2.0 card information. Only one of the five codes needs to be implemented to carry the information, but the choice is to offset the possibility that the option code chosen has been used for other purposes.

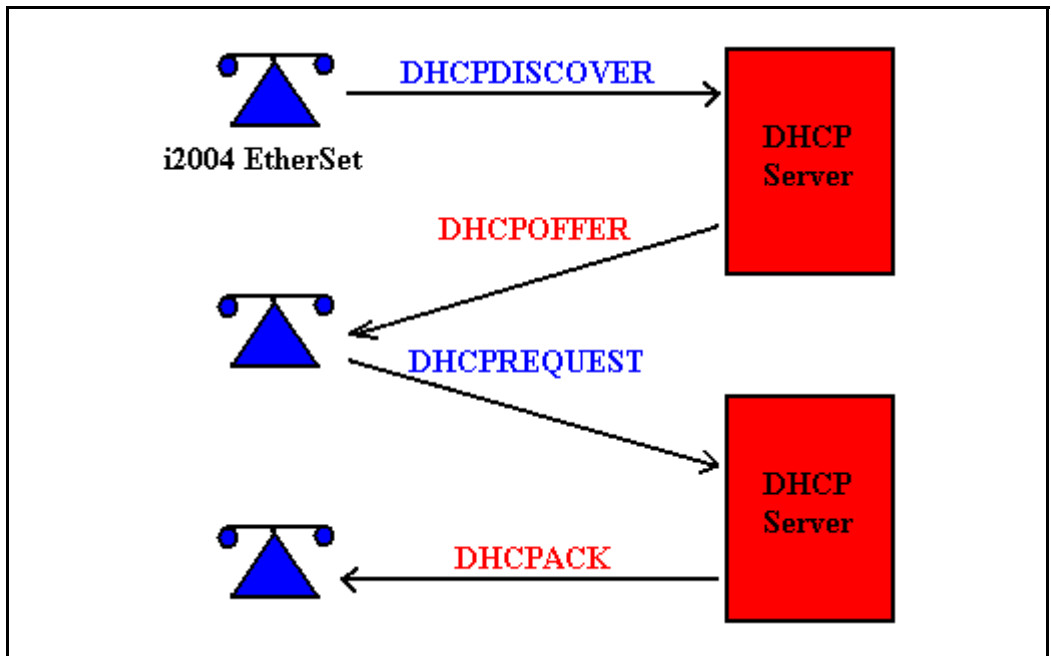
## IP Acquisition Sequence

This section focuses on the mechanics and sequence of the DHCP message exchange as the i2004 Internet Telephone uses DHCP for IP acquisition. Although the i2004 Internet Telephone requests many network configuration parameters as well as an IP address, the following cases focus on the concept of "how" instead of "what" information is acquired. Also, the i2004 Internet Telephone is used as the sample client but most of the illustrations apply to other DHCP clients as well.

### Case 1

Case 1 is a typical situation where the i2004 Internet Telephone requests services from a DHCP server. This is illustrated in Figure 42 and explained on page 287.

**Figure 42**  
**IP Acquisition Phase - Case 1**



- 1 The i2004 Internet Telephone initiates the sequence by broadcasting a

DHCPDISCOVER message.

- 2 A DHCP server on the network sees the broadcast, reads the message, and records the MAC address of the client.
- 3 It checks its own IP address pool(s) for an available IP address and broadcasts a DHCPOFFER message if one is available. (Usually the server ARPs or PINGs the IP address to make sure it is not being used.)
- 4 The i2004 Internet Telephone sees the broadcast and after matching its MAC address with the offer, reads the rest of the message to find out what else is being offered.
- 5 If the offer is acceptable, it sends out a DHCPREQUEST message with the DHCP server's IP address in the Server IP address field.
- 6 The DHCP server will match the IP address in the Server IP address field against its own to find out who the packet belongs to.
- 7 If the IPs match and there is no problem supplying the requested information, it assigns the IP address to the client by sending a DHCPACK.
- 8 If the final offer is not rejected, the IP acquisition sequence is complete.

## Case 2

The IP acquisition becomes unsuccessful if either the server or the client decides not to participate.

If the DHCP server cannot supply the requested information:

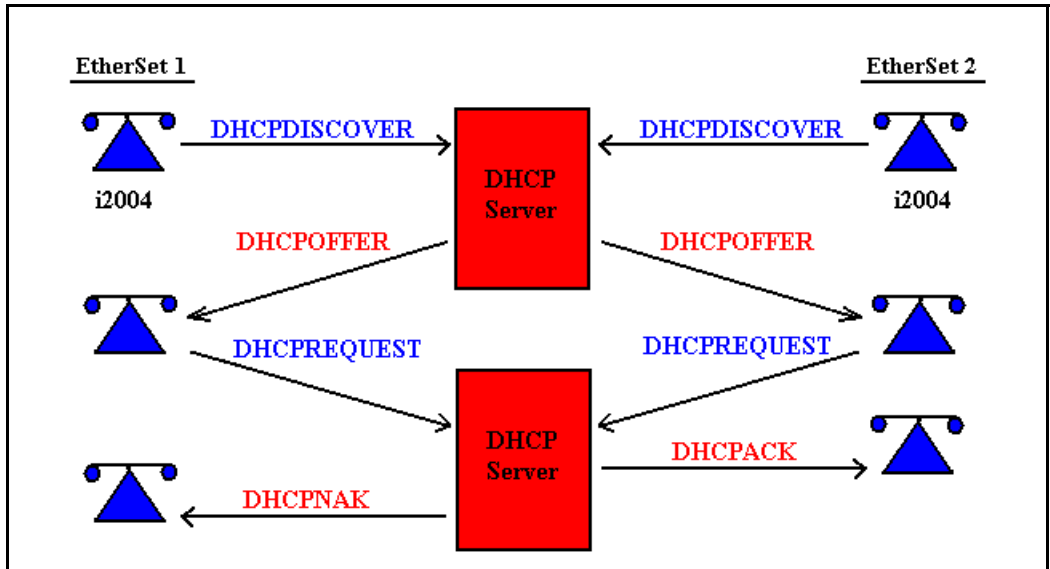
- It sends a DHCPNAK message and no IP address is assigned to the client. This can happen if the requested IP address has already been assigned to a different client (see Figure 43 on page 289).

If the Client decides to reject the final offer (after the server sends a DHCPACK message):

- the Client sends a DHCPDECLINE message to the server, telling it the offer is rejected.
- the Client will have to restart the IP acquisition by sending another DHCPDISCOVER message, in search of another offer.



**Figure 43**  
**IP Acquisition Sequence - Case 2**



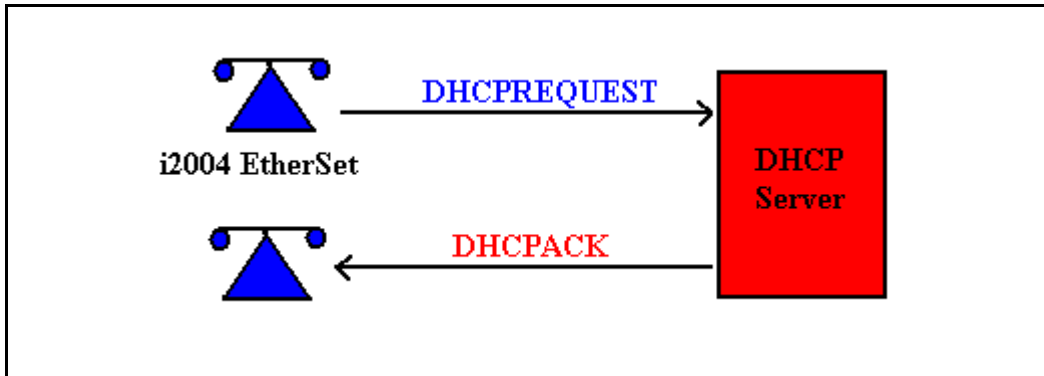
### Case 3

Finally, when a client is finished with a particular IP address, it sends a DHCPRELEASE message to the server which reclaims the IP address. If the client requires the same IP address again, it can initiate the process as follows:

- 1 i2004 Internet Telephone broadcasts a DHCPREQUEST to a particular DHCP server by including the server's IP address in the Server IP Address field of the message. Since it knows which IP address it wants, it requests it in the DHCP message.
- 2 The DHCP server sends a DHCPACK message if all the parameters requested are met.

Case 1 is similar to Case 3, except the first two messages have been eliminated. This reduces the amount of traffic produced on the network (see Figure 44).

**Figure 44**  
**IP Acquisition sequence - Case 3**



## Multiple DHCPOFFERS

In some networks, if more than one DHCP server is present, a client can receive multiple DHCPOFFER messages. Under these situations, the IP acquisition sequence depends on the client. The client can wait for multiple offers, or just go with the first offer it receives. If it accepts multiple offers, it compares them before choosing one with the most fitting configuration parameters. When a decision is made, the message exchange is the same as if there is only one DHCP server and proceeds as in the previous Cases. The servers that have not been chosen to provide the service do not participate in the exchange.

The i2004 Internet Telephone only responds to DHCPOFFERs, that have the same unique string identifier, "Nortel-i2004-A" as the i2004 Internet Telephone. This string must appear in the beginning of the list of ITG Line 2.0 card parameters. Without this string, the i2004 Internet Telephone does not accept the DHCPOFFER, even if all parameters requested and ITG Line 2.0 card information are present. If no valid DHCPOFFERs are sent then, the i2004 Internet Telephone keeps broadcasting in search of a valid offer.

With multiple DHCP servers on the same network, a problem can occur if any two of the servers have overlapping IP address range and no redundancy. DHCP redundancy is a property of DHCP servers, which allows different DHCP servers to serve the same IP address ranges simultaneously. Administrators must be aware that not all DHCP servers have this capability.

## **i2004 support for DHCP**

DHCP support in the i2004 Internet Telephone includes sending a Class Identifier option with the value "Nortel-i2004-A" in each DHCP Discovery and Request. Additionally, the i2004 checks for either a Vendor Specific option message with a specific, unique to Nortel i2004, encapsulated sub-type, or a Site Specific DHCP option. In either case, an i2004 Internet Telephone specific option must be returned by the i2004-aware DHCP server in all DHCPOFFER and DHCPACK messages. The i2004 Internet Telephone uses the information returned in this option to configure itself for proper operation. This includes binding a new IP address, netmask and default gateway (for local IP stack) as well as configuring the primary bootstrap server and optional secondary server.



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# List of terms

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## Active Leader

The Leader that at a given instant of time is performing the Leader role of being the designated point of contact in the group of Follower cards for all the Meridian systems in the network. The active leader card also provides endpoint management including registration/unregistration, authentication, address resolution (DN to IP and endpoint to gateway), and maintaining a list of endpoints currently active on the network.

## Backbone

A network's major transmission path, handling high-volume, high-density traffic.

## Bandwidth

A measure of information carrying capacity available for a transmission medium, expressed in bits per second. The greater the bandwidth, the more information that can be sent in a given amount of time.

## BootP

Bootstrap Protocol. Protocol used for communication between ITG cards. A protocol that allows network hosted systems to determine their IP address and other operational information via a simple datagram exchange with a central server.

## Bridge

LAN equipment providing interconnection between two networks using the same addressing structure. A bridge filters out packets that stay on one LAN and forwards packets intended for other LANs.

## CD-ROM

Compact Disk - Read Only Memory.

**CDP**

Coordinated Dialing Plan.

**CLS**

Class of Service.

**CO**

Central Office.

**Codec**

Equipment or circuits that digitally code and decode voice signals. The ITG Line 2.0 card product uses the G.729 Annex AB codec.

**Communications protocol**

A set of agreed-upon communications formats and procedures between devices on a data communications network.

**CPU**

Central Processing Unit.

**Data communications**

Processes and equipment used to transport signals from a data processing device at one location to a data processing device at another location.

**DSP**

Digital Signal Processor.

**ESN**

Electronic Switched Network.

**EXUT**

Enhanced Extended Universal Trunk card (analog trunk).

**FNP**

Flexible Numbering Plan.

**Follower card**

An ITG Line 2.0 card which has no specific role other than providing gateway functionality. See also *Gateway*.

**Full-duplex transmission**

Simultaneous two-way independent transmission in both directions.

**Gateway**

Gateways in the system contain two interfaces: one interface to the Meridian 1, and the other to the IP network. The gateway provides the necessary conversion for both call signalling and voice stream/packets across the two interfaces. The gateway functionality on the ITG platform is provided by the ITG Line 2.0 cards.

**G.729AB**

A codec supported by ITG that provides near toll quality at a low delay. Uses compression to 8 kbps (8:1 compression rate).

**GW**

Gateway.

**Hub**

Center of a star topology network or cabling system.

**IP**

Internet Protocol.

**Installation Summary Sheet**

A sheet used during IP Telephony Gateway Line 2.0 card installation to summarize and record important information about cards.

**LAN**

Local Area Network. Data-only communications network confined to a limited geographic area, with moderate to high data rates. Contrast with WAN.

**Latency**

The amount of time it takes for a discrete event to occur.

**Leader card**

An ITG Line 2.0 card which is a designated point of contact, in the group of Follower cards and the backup Leader, for all the Meridian systems in the network. See also *Active Leader*, *Backup Leader*, *Leader 0*, and *Leader 1*.

## **Leader 0**

The Leader 0 card is the MAT term for the ITG Line 2.0 card that initially assumes the active Leader role. See also *Active Leader*, *Backup Leader*, and *Leader 1*.

## **Leader 1**

The Leader 1 ITG card is the MAT term for the ITG Line 2.0 card that initially assumes the backup Leader role. See also *Active Leader*, *Backup Leader*, and *Leader 0*.

## **MAT**

Meridian Administration Tools. MAT is a Windows 95/98 and Windows 4.0 Workstation application that configures Meridian 1.

## **Mbps**

Mega-bits per second. Millions of bits per second.

## **MDF**

Main Distribution Frame.

## **Modem**

Device that converts serial digital data from a transmitting terminal to an analog signal for transmission over a telephone channel, and another modem reconverts the signal to serial digital data for the receiving terminal.

## **MOS**

Mean Opinion Score. MOS value reflects the customer opinion of voice quality and ranges from 0 to 5, where 0 means bad quality and 5 means excellent voice quality.

## **MTBF**

Mean Time Between Failure. A measure of reliability: the time that a user can reasonably expect a device or system to work before an incapacitating fault occurs. Also, the average number of hours between one random failure and the next under stated conditions.

## **NANP**

North American Numbering Plan.



**Noise**

Random electrical signals, generated by circuit components or by natural disturbances, that corrupt communications.

**NPA**

Numbering Plan Area.

**NXX**

Numbering Plan Exchange (Central Office).

**OA&M**

Operations, Administration, and Maintenance.

**Packet**

Group of bits transmitted as a complete package on a packet-switched network.

**Packet switched network**

A telecommunications network based on packet switching technology, where a link is occupied only for the duration of the transmission of the packets.

**PCMCIA**

Personal Computer Memory Card International Association. This organization has defined a credit card sized plug-in board for use in PCs. Application software can be stored on the card into system address space so that the software can run directly from the card, resulting in a faster start and less memory required from the host computer.

**PPP**

Point-to-point protocol. A TCP/IP routing protocol for communications over serial lines without intervening adapters, such as modems.

**PSTN**

Public Switched Telephone Network.

**QoS**

Quality of Service.

**RAS**

Registration, Admission, and Status.

**RTT**

Round Trip Time.

**SNMP**

System Network Management Protocol. Protocol used to communicate MAT ITG alarms or events.

**Subnet**

Means of splitting packets into two fields to separate packets for local destinations from packets for remote destinations in TCP/IP networks. This makes small networks more efficient.

**TCP/IP**

Transmission Control Protocol/Internet Protocol. Protocol for internetwork routing and reliable message delivery.

**Telnet**

Standardized application providing a terminal interface between nodes, using the TCP/IP network protocol.

**Terminal**

Device capable of sending or receiving data over a data communications channel.

**Throughput**

Indicator of data handling ability. Measures how much data is processed as output by a computer, communications device, link, network, or system.

**Topology**

Logical or physical arrangement of nodes or stations.

**UDP**

1. Uniform Dialing Plan. A dialing plan supported by ITG.
2. User Datagram Protocol. ITG sends signaling and voice over a TCP/IP and UDP/IP signaling stack.

**Voice compression**

Method of minimizing bandwidth by reducing the number of bits required to transmit voice.

**VoIP**

Voice over IP. Used synonymously with XoIP.

**XoIP**

Voice or Fax over IP.

**WAN**

Wide Area Network. Network using common carrier-provided lines that covers an extended geographical area. Contrast with LAN.



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Meridian 1

## **Meridian Internet Telephony Gateway (ITG) Line 2.0/i2004**

### **Internet Telephone**

#### **Description, Installation, and Operation**

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